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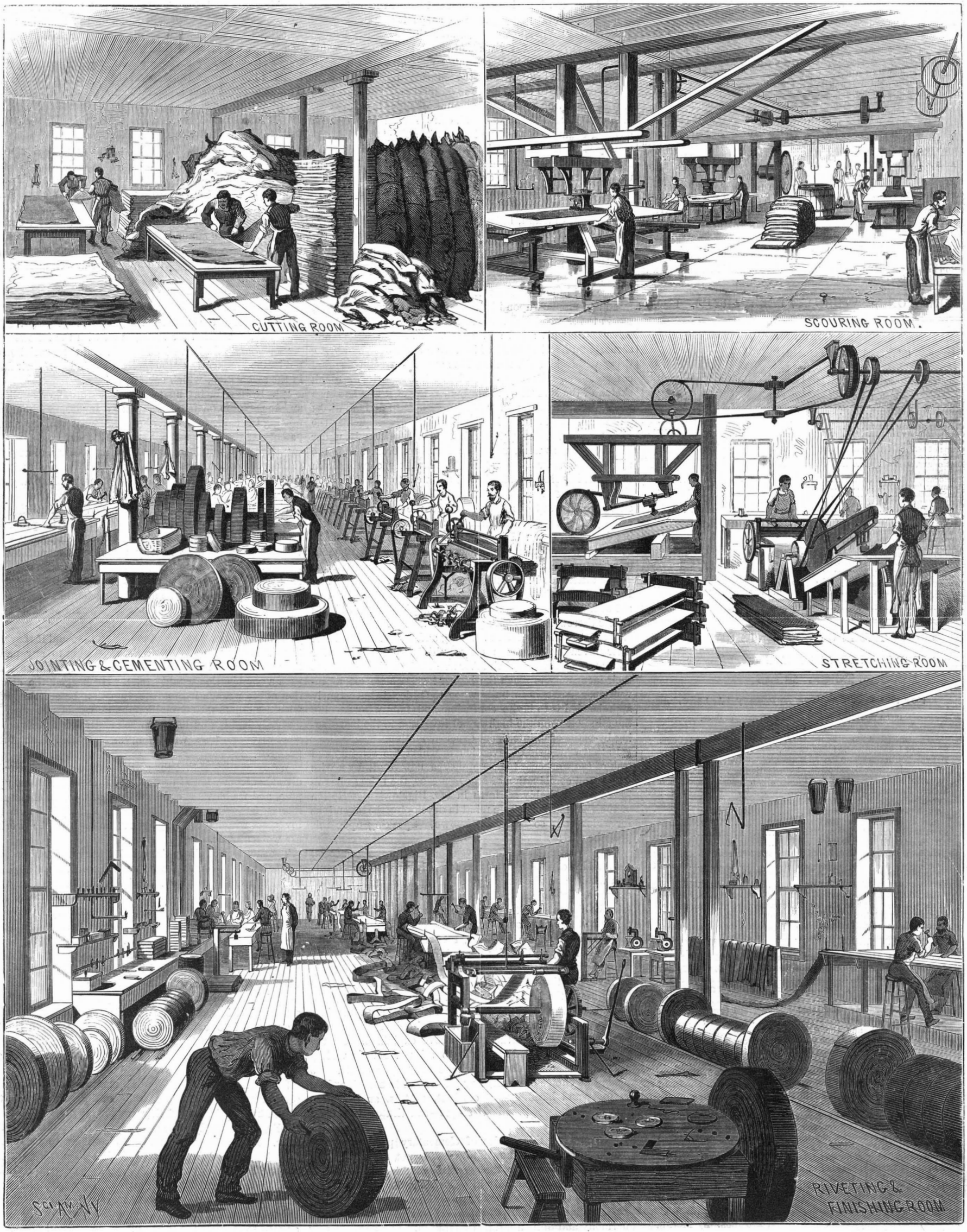

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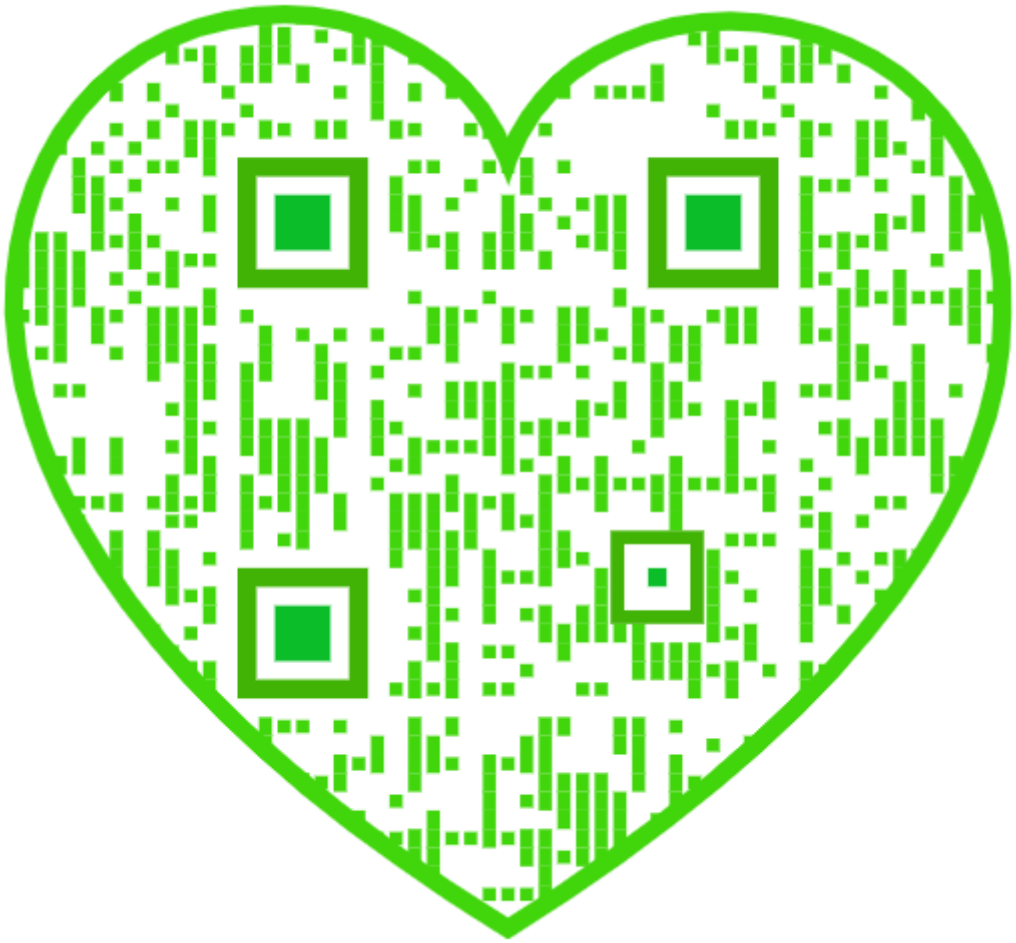

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HOW GREAT INVENTIONS ARE MADE.

There is a very prevalent notion that an inventor is a tinkering fellow, an uneasy sort of mechanic who is always experimenting, cutting, and trying, with a vague expectation of some day hitting upon something novel and possibly useful. Doubtless there are in almost every community men who waste their time and means in brainless labor of that character, would-be inventors, who, having no clean cut or well considered purpose in view, are ever busy at nothing, making a show of invention without ever inventing anything. But such men are no more worthy of the name of inventor than the corner loafer who wrangles over the affairs of local politics is worthy of the name of statesman.

The real inventor is a man of an entirely different type. He knows precisely what he is driving at, and very frequently his invention is entirely thought out before the first stroke is made to put it upon paper or to shape it in a more material form. "When you strike a difficulty, what do you do?" was asked of an inventor whose fame is world wide for his many achievements in overcoming alleged impossibilities. "I sit down and think," was the sufficient reply.

The capacity to think is the inventor's first and most essential endowment, and no amount of tinkering, however patient and mechanically skillful, can ever take its place. A striking example of the true inventor's ability to think creatively is furnished in the inventions of the late Erastus B. Bigelow. He was not a mechanic, he had no practice in the use of tools, he could not even handle a pencil with skill and facility. His inventions were made in the recesses of his brain, where the complicated machinery of each was created, thought out in detail, before any attempt was made to give it material embodiment. To a writer in the last issue of the *Bulletin* of the National Association of Wool Manufacturers, Mr. Bigelow said that his most recent carpet loom—one upon which seventy-two yards of Brussels carpet have been woven by one girl in ten hours—was completely worked out in his mind and mapped upon his brain, not in his study or factory, but in the railroad cars while making his last visit in Europe. After sating his mind and eyes with foreign sights and scenery, an irresistible fit of invention came over him. Retiring within himself, the machine soon assumed in his mind complete form in every part and detail. Showing a rough sketch of the invention, the only drawing of it that had been made, Mr. Bigelow said: "All I have now to do is to direct a draughtsman to work in the details." Subsequently the narrator saw the draughtsman in the inventor's study, under his direction, at work upon the drawings from which the machine was to be constructed. The inventor, copying from the plans imprinted on his brain, dictated to the draughtsman (who acted as a mere pantograph) every line, circle, and curve which was to be transferred to the paper, giving its exact place, length, and dimensions. The result was a working drawing, from which alone the machinists were able to construct a perfect machine, working without experiment or adjustment exactly as it was contrived by the inventor.

The difference between the working of a mind like Mr. Bigelow's and that of an inferior inventor is one of degree, not of kind. The same kind of thinking is done with more or less thoroughness by every true inventor And those who stop short in their creative thinking and begin to materialize their invention too soon only multiply their chances for going wrong, increase their labor needlessly, and demonstrate their incapacity to reach the higher levels of the art of invention. To begin to build when the object is but vaguely apprehended is to invite confusion and failure by turning the mind off from the highway of invention to the bewildering by-paths of unintelligent experimentation.

In that wide field of invention in which the self-imposed task of the worker is to accomplish a new result by a wise choice and combination of known means, the rules to be followed are admirably set forth in Mr. Bigelow's description of the working of his own mind in developing the inventions for which he is so honorably known. Speaking upon this point he said:

"My first step toward an invention has always been to get a clear idea of the object aimed at. I learn its requirements as a whole, and also as composed of separate parts. If, for example, that object be the weaving of coach lace, I ascertain the character of the several motions required, and the relations these must sustain to each other in order to effect the combined result; secondly, I devise means to produce those motions; and thirdly, I combine those means and reduce them to a state of harmonious co-operation. To carry an invention through the first and second stages is comparatively easy: the first is simply an investigation of facts; the second, so far as I can trace the operations of my own mind, comes through the exercise of the imagination. I am never at a loss for means in the sense above explained. On the contrary, my chief difficulty is to select from the variety always at command those which are most appropriate. To make this choice of elementary means and to combine them in unity and harmony—to conduct, that is, an invention through its last practical stages—constitutes the chief labor.

"In making this choice of elementary parts one must reason from what is known to what is not so—keeping in mind, at the same time, the necessary combinations, examining each element, not only in reference to its peculiar function, but to its fitness also for becoming a part of the whole. Each device must be thus examined and re-examined until harmony and unity are fully established. I find no difficulty in effecting that concentration of thought which is so necessary in pursuits like mine. Indeed it is not easy for me to withdraw my mind from any subject in which it has once become interested until its general bearings, at least, are fully ascertained. I always mature in my mind the general plan of an invention before attempting to execute it, resorting occasionally to sketches on paper for the more intricate parts. In building a machine a draughtsman prepares the working drawing from sketches furnished by me, which indicate in figures the proportion of the parts, I never making anything with my own hands. I do not like even drawing to a scale."

Inventors less favored by nature with the power of close and long continued mental concentration which Mr. Bigelow was blessed with, or lacking the vividness and accuracy of his conceptions and the strength of memory which enabled him to hold fast the mental image of a complicated machine which his imagination had put together, may have to resort sooner to the pencil sketch or the material model. But these are apt to become distractions rather than aids, and the young inventor should study to do without them as long as possible. The moment the inventor materializes an idea his power over it is so far lessened. If the material form is not just what it should be to suit the ultimate combination it is far harder to recast it, in the third stage of invention as described by Mr. Bigelow, than it would be if preserved as a purely mental conception.

Of course to the man who has creative mental power, a hand skilled in the arts of drawing and mechanical construction may be, and if properly exercised will be, a desirable adjunct in the art of invention; but it is not an essential factor, for many successful inventors have been, like Mr. Bigelow, unable to give their new conceptions material embodiment; and where manual skill furnishes a too ready incentive to the overhasty materialization of crude ideas, it is an accomplishment which the genuine inventor can well afford to dispense with.

THE IMPOLICY OF ANTI-PATENT COMBINATIONS.

The report of the Executive Committee of the Western Railroad Association for 1879 sets off with the following:

"*Duties of Members.*—The members of the association can not be too frequently or too forcibly reminded of their duties in the association, which consist, chiefly:

"I. In introducing no new device, process, or appliance, and to make no change in those now in use, without submitting the same for an opinion as to what and how many patent or patents the same is subject to; and

"II. The entertaining, much less the settling, of no patent claim without an investigation thereof by the association; and never, except in extraordinary cases, settling any such claim contrary to the advice received."

When the National Association of Wool Manufacturers was founded, an especial object of many of its prominent promoters was a combination to resist certain patents which were supposed to bear heavily upon wool manufacturers. Against this course the first president, Erastus B. Bigelow, took the high ground that the association had better work to do. He said that if the association should attempt to inquire into the validity of patents they would be liable to the imputation of combining to defeat inventors. They had no power to decide questions of patent rights; and if they were to go into any court as a body in opposition to any patent, they would only invite defeat through the prejudice which such a combination would excite. He begged the association not to weaken its influence by going before the public with any object which public opinion would not regard as perfectly legitimate; and his wisdom carried the associated wool manufacturers with him, and decided their future policy.

We are confident that the association has not regretted its diversion from what at first seemed to many its primary purpose, and we have never heard that the wool manufacturing interest has grievously suffered at the hands of the numerous inventors who have so largely revolutionized the work of the woolen trade.

The Western Railway Association have undertaken to do what the wool manufacturers wisely saw to be impolitic, and the peculiar relations subsisting between railway corporations and the public are such as to make it vastly more impolitic on their part to combine for anti-patent purposes. The manufacturers of wool had received no favors at the hands of the general public, and their work was strictly private in character. Not so the work of the railway companies. They have received large grants of land and other valuable franchises from the public, not for the enrichment of their stockholders, but for the public good. They are common carriers, and in view of the conditions under which they come into existence, the community has a right to insist that the carriage of persons, property, and mails by them shall not be needlessly delayed or rendered needlessly hazardous.

Should an association of wool manufacturers decline to give place in their factories to an improved loom, they would be foolish, but, being under no obligation to the public, they would not be amenable to that public for their folly. For railway companies to combine to prevent the adoption, say, of an improved brake, is a very different matter; and the associated railway companies cannot afford even to be suspected of such action. As a natural effect of their unwisdom in this respect, we see before Congress a bill to compel railways to adopt and use improvements calculated to increase the safety of passengers and mails. The railway managers say that this is an unwarrantable and an unjust invasion of their rights; but that is a question for

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the courts to decide, should the proposed bill be passed by Congress.

Right or wrong the attempt by Congress to compel railways, as General Banks' bill reads, to "put into actual and continual use such inventions and improvements as shall, upon thorough trial tests, actually contribute to the comfort, security, and safety of persons being transported as passengers," and tend to prevent delays in the transmission of mails, etc., may be taken as a natural and inevitable result of the attempt on the part of the associated railways to refer all action with reference to improvements to an outside and irresponsible organization. And as the people of the United States are more numerous and more powerful than any possible association of railway officials, it is the reverse of politic on the part of the latter to provoke a conflict which can only result in their overwhelming defeat.

THE WESTERN RAILWAY ASSOCIATION AND THE PATENT LAWS.

Speaking of the failure of their efforts to secure the passage of the bill to effect a general amendment of the patent laws last winter, the executive committee of the Western Railroad Association say, in their report for the year just closed:

"For many reasons, but principally on account of the success which has of late attended the work of the association in contesting unjust claims, and in settling just ones equitably, your committee has made no special efforts in this direction during the present Congress."

American inventors will be pleased to see this frank admission by the association that for all legitimate purposes the patent laws are adequate as they stand. No fuller justification could be asked for the position taken by the friends of inventors during the contest in the last Congress, namely, that the general invasion of the constitutional rights of inventors proposed in the Association's bill (S. 300), was as unnecessary as its object was unjust. Now, having admitted that the present laws are sufficient to enable them to contest successfully unjust claims, and to settle just ones equitably—certainly all that any association can reasonably ask—it is to be hoped that the Western Railway Association will have the grace to cease to whine about the alleged oppressions of patentees, and refrain from further attempts to have the patent system recast so as to place inventors at the mercy of any who might choose to infringe their rights.

THE PROPOSED WORLD'S FAIR IN 1883.

One decided advance has been made toward securing a World's Fair in this city three years hence. The two rival organizations which had the project in hand have given place to a single committee made up of citizens of accredited social and financial standing. There has also been introduced in Congress a bill creating for the management of the proposed Fair a United States International Commission, composed of sixty honorably known citizens of New York, two commissioners from each State, one from each Territory, and one from the District of Columbia. It is further provided in the bill that the Exhibition be held under the direction of the Commission as one body; that the Board of Finance be elected by the subscribers to the stock, and that those elected thereby become, if not already so, a part of the Commission—thus avoiding any troubles that might arise from a dual organization; that the capital stock be placed at twelve millions of dollars, in shares of ten dollars each; and that foreign nations be invited by the general government to participate in its exhibition.

No appropriation is asked for, but there is no provision against such an application in the future. The list of incorporators is made up of names that ought to inspire confidence. Each of the gentlemen named has agreed to serve on the commission, and all together they furnish a reasonable guarantee that the undertaking will be wisely managed.

THE LOGIC OF GOVERNMENT CONTROL.

For a number of years the propriety of transferring to the National Government the control of railways and telegraphs, as in some European States, has been strongly urged in this country. This, on the plea of cheapness and good management, notwithstanding the too frequent experience that the business affairs of the government are apt to be badly conducted, and their results obtained at a far greater cost than for similar work in private hands.

The action of the British Postmaster General in relation to the telephone companies furnishes a pretty illustration of the logical result of such government monopolies. Every one knows that a few years ago the British Government acquired possession of all the telegraph lines of the United Kingdom, and made them a part of the postal service. By the same act, as English electricians aver, the government put a practical extinguisher upon telegraphic improvements in Great Britain—a natural result of bureau management. But this is not the worst of it. Government monopolies are not only fatal to progress in their tendency to discourage invention, but they are very apt to become aggressive, and try to suppress outside rivalry. Hence the natural but none the less amazing attack upon the English telephone companies by the Right Honorable Lord John Manners, who filed an information in the Court of Queens Bench, Jan. 20, asking an injunction to restrain the English Telephone Company and Edison's Telephone Company from using wires for the transmission of messages.

The next day in the Exchequer division of the High Court of Justice, application was made by the Attorney General on the part of the Post Office for an *ad interim* injunction to restrain the English Telephone Company and the Edison Telephone Company from discharging the functions for which they were called into existence. After some discussion it was arranged that an injunction should not be taken, but that the defendant companies were to keep certain accounts until the hearing and final decision of the case. The argument on behalf of the Post Office is that telephones are telegraphs within the meaning of the act by which the latter inventions were committed to the charge of the Post Office Department, and the Attorney General represented it to be a serious grievance that the government, after spending millions on telegraphs, now found their monopoly interfered with by telephones, which he submitted were practically the same invention. It is reported, although this part of the question was not mentioned during the hearing, the Post Office officials hope to be able to compel the telephone companies to take out licenses from the Postmaster General and pay royalties for carrying on their business. The trial of the case is set down for an early day in February.

THE OWNER OF THE CAPE OF GOOD HOPE AND HIS OSTRICH FARM.

Mr. McKellar, who was most kindly hospitable, has an ostrich farm, but his flock of birds was not very large at the time of our visit, he having had bad luck at first in breeding.

He owns the actual Cape of Good Hope and a long stretch of the moorland adjoining, and has thrown a wire fence right across the peninsula, so as to give his ostriches the run of a large tract, stretching right down to the cape itself. One old hen ostrich was a pet about the house, but used to do sad damage in the farm yard eating the young goslings, swallowlowing them like oysters.

It was amusing to go with Mr. McKellar into one of his breeding paddocks; here a pair of ostriches were brooding on a nest of eggs, dividing, as usual, the labor between them.

The cock was very savage and attacked all intruders, so his master had a long pole with a fork at the end of it, and when the ostrich ran at the party he caught its neck in the fork. The ostrich was excessively enraged, but soon had to give in.

A kick from an ostrich is well known as very dangerous. The only thing to do when attacked without means of defense, Mr. McKellar said, is to lie flat down and let the bird walk on you till he is tired. I was astonished at the brightness of the red coloring developed on the front of the legs of the cock bird during the breeding season. The ornamental appearance of the bird is greatly enhanced by it.

A narrow but strong and high pen is provided for plucking the birds in. They are driven into it and held fast. It is found better to pluck the feathers out than to cut them off. The stumps, if left in, are apt to cause trouble.

Young ostriches, when first from the egg, have curious horny plates at the tips of their feathers, like those in the feathers of one of the Indian jungle fowls, and some other birds not in the least related to one another.

The cape peninsula becomes very narrow towards its termination, and ends in two capes, Cape Point, on which is the lighthouse, and the Cape of Good Hope. The Cape of Good Hope itself is a mass of rock, terminating in perpendicular cliffs toward the sea, but with ledges here and there, on which numbers of cormorants (*Phalacocorix capensis*) nest.—*H. N. Moseley, Challenger Notes.*

Sewer Gas and Disease.

The authorities of one of the largest hospitals in London lately took measures to ventilate all the drains and sewers in connection with their institution. Up to the time these alterations were made, pyæmia and erysipelas had almost driven the medical staff to despair. When the whole of the ventilation was completed, and as soon as the pressure was removed from the traps of the closets and lavatories, no fresh cases were found to occur. For months the hospital wards were free from both erysipelas and pyæmia. Suddenly, however, there was a fresh outbreak of these diseases, but it was noticed that the epidemic was confined to one of the surgical wards, built apart from the main building, on the pavilion plan, and having only one story. Close investigation proved that the ventilation pipe in this wing had been stopped up by a careless workman. When this was remedied, all traces of the epidemic disappeared.

The Millers' International Exhibition.

A bill was passed in the House of Representatives, January 15, providing for the importation, free of duty, of all articles for exhibition at the Millers' International Fair, to be held in Cincinnati, Ohio, during the coming summer. The Exhibition will be opened June 1. The machinery will be shown in motion.

In view of the enormous interests involved in milling, the variety of grains made use of, the numerous rival systems and processes employed, and the wide range of invention covered by milling apparatus, it is safe to predict a notable Exhibition. American millers and mill furnishers are taking a lively interest in the Fair, and the president of the National Millers' Association reports a fine prospect for a full and instructive display.

MACASSAR OIL.—Sunflower oil, 100 grammes; goose grease and "kamfett," of each 15 grammes; liquid storax, oil of eggs, oil of thyme, cacao butter, of each 8 grammes; neroli, 4 grammes; Peruvian balsam, 0·6 gramme; otto of roses, 0·05 gram.—*Henkenius.*

Kind Words from Chicago.

Our newspaper contemporaries are constantly saying good words for the SCIENTIFIC AMERICAN and our other publications. We are not unmindful of such courtesies, although we seldom occupy space in these columns for giving them expression; but the following from the Chicago *Journal of Commerce* is so well put, we beg the indulgence of our readers for giving it place:

"The SCIENTIFIC AMERICAN is one of the really standard publications of the day. Established in 1845, it has now reached the thirty-fifth year of its publication. The success of this publication has been something remarkable, and its circulation is now *fifty thousand copies* weekly. It is a paper that ought to find its way into every workshop in the land, without a single exception. It is invaluable to the mechanic, artisan, and inventor, and the wide field it covers makes it alike invaluable to those interested in purely scientific and chemical pursuits. Its handsome pages and accurate illustrations of new inventions, machinery, workshops, and sketches in natural history are all in entire keeping with the active spirit of this progressive age, and there are, indeed, few publications more deserving of a place in the homes of our land. The SUPPLEMENT—which is a distinct paper from the SCIENTIFIC AMERICAN—contains sixteen octavo pages, with handsome cover, uniform in size with the SCIENTIFIC AMERICAN. This is really a royal issue, and while the price of the SCIENTIFIC AMERICAN is placed at $3.20 per year, or $1.60 for six months, the SUPPLEMENT is placed at $5.00 per year, postage paid, to subscribers. Money could not be more judiciously expended than by subscribing for these publications."

The Indian and the Telephone.

An amusing application of the wonders of the telephone as an assistant detective of crime comes to us from Julian. Several horses were recently stolen in that neighborhood, and suspicion fell upon a certain Indian as the thief. Some one having introduced a telephone up there, the same was being exhibited, when it occurred to the owner of the stolen horses to get the Indian to come in and hear the "Great Spirit" talk. The Indian took one of the cups and was thrilled with astonishment at being apparently so near the Great Keeper of the happy hunting grounds. After some little time spent in wonderment, the Indian was solemnly commanded by the Great Spirit to "give up those stolen horses!" Dropping the cup as if he had been shot, the Indian immediately confessed to having stolen the horses, and tremblingly promised if his life was spared he would restore the "caballos" at once, and he did so.—*San Diego (Cal.) Union.*

Curiosities of the Telephone.

With a single telephone held, say, to the right ear, the transmitted voice appears to come from a distance to the right; while with a telephone held to the left ear, it seems to arrive from the left of the listener.

With a telephone to each ear, if one ear be less sensitive than the other, or if the telephone be held further from that ear, the voice apparently shifts to the side of the other ear; and if both ears hear alike and both instruments are equally near their respective ears, the voice apparently proceeds from in front of the observer.

Petroleum in Hanover.

Borings are being made in the Hanover petroleum district with such promising results as to make the prospectors extremely hopeful. A dispatch from Berlin says that the borings are now 60 feet deep, and the existence of a petroleum basin as large and rich as the one in Pennsylvania is regarded as beyond doubt by mining experts. The deepest borings already yield four hundredweights of oil per well daily, and the quality of the oil is improving. The work is being prosecuted by Hamburg and Bremen firms engaged in the American trade.

Cheap Indelible Ink.

Braconnot recommends the following: 20 parts of potassa are dissolved in boiling water, 10 parts of fine cut leather chips and 5 parts of flowers of sulphur are added, and the whole heated in an iron kettle until it is evaporated to dryness. Then the heat is continued until the mass becomes soft, care being taken that it does not ignite. The pot is now removed from the fire (allowed to cool), water is added, the solution strained, and preserved in bottles. This ink flows easily from the pen.—*Pol. Notizbl.*

Large Farming.

It is reported that Mr. Oliver Dalrymple, the great Minnesota farmer, intends to cultivate 30,000 acres of wheat this year. He will have 20 steam thrashers in operation with 135 reaping machines. Last year he employed 600 laborers, and this year will increase the number to 700.

THE woolen trade in France has been making rapid progress. In 1851 there were only 850,000 woolen spindles in that country, but now they number 2,270,000, thus distributed among the departments: Nord has 1,350,000; Marne, 160,000; Somme, 125,000; Ardennes, 120,000; Aisne, 140,000; others, 375,000. The value of the woolen yarns exported amounted to 32,200,000 francs; of manufactured goods, to 464,200,000 francs; of combed wool, to 30,900,000 francs; of woolen waste, to 36,700,000 francs; making a grand total of 564,000,000 francs. About 147,632,000 francs were paid for wages annually.

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HINTS TO THE YOUNG STEAM FITTER.

BY WM. J. BALDWIN.

RADIATION.

Heating surfaces are divided into three classes: 1st, direct radiation; 2d, indirect radiation; and 3d, direct-indirect radiation.

Direct radiating surfaces embrace all heaters placed within a room or building to warm the air, *and are not directly connected with a system of ventilation,*

The best place in a room to put a radiator is where the moist air is cooled—namely, before or under the windows, or on the outside walls. When the heater is a vertical tube radiator, or a short coil, which can occupy only the space of one window, and, as often happens in corner rooms, there are three windows, the riser should be so placed as to bring the line of radiators in front of and under the windows where they will do the most good—say the middle window; or, better still, when a small extra cost is not considered, use two heaters, and place one in front of each extreme window.

When the room is large and has many windows, the heating surface should be divided into as many parts as there are windows; or, if the occupants object to so many windows being partly obstructed, divide into half as many parts and distribute accordingly.

In schools or buildings with many windows, where children or persons cannot change their positions, but have to remain seated for several hours at a time, care must be taken that the heating surface is very evenly distributed. A miter coil run the whole length of the outside wall is best, but if any kind of short heaters are used, every window should have its quota. Should a single window be left unprovided for, it will be found by experiment that a cold current of air will fall down in front of said window and flow along the floor in the direction of the nearest heaters, and cause cold feet to any who are in its passage.

The natural currents in a room, with the outside atmosphere the coldest, are down the windows and outside walls, and up at the center or rear walls. This downward and cold current should be met by the heated and upward current from the radiator, and reversed and broken up as much as possible.

Indirect radiation embraces all heating surfaces placed outside the rooms to be heated, *and can only be used in connection with some system of ventilation.*

There are two distinct modifications of indirect radiation. One where all the heating surface is placed in a chamber, and the warmed air distributed through air ducts and impelled by a fan in the inlet or cold air duct. The other where the heating surface is divided into many parts, and placed near the lower ends of vertical flues leading to the rooms to be heated.

The first of this class—namely, *chamber-heat*—has not proved a great success, and architects and steam heating engineers are likely to have very little more to do with it, as it has been found that in windy weather it is almost impossible to force air to the side of a house or building against which the wind blows. The second of this class has done better, as it admits of taking advantage of the force of the wind to aid in bringing the warmed air into the rooms.

In estimating the heating surface for low pressure indirect radiation it is well to nearly double what would be used for direct radiation; but when the steam pressure is high, and the supply ample to maintain the pressure in the heater, the surface may be reduced directly as to the increase in temperature of steam to be carried.

The indirect heater is usually boxed, either in wood lined with tin or in sheet metal. The former is best when the cellar is to be kept cool, as there is a greater loss by radiation and conduction through metal cases; otherwise metal is best, as it will not crack, and when put together with small bolts, can be removed to make repairs without damage.

The vertical air ducts are usually rectangular tin flues built into the wall when the building is going up; sometimes they are only plastered; but round, smooth metal linings with close joints give much the best results. The cross section of an air duct should be comparatively large, as a large volume of warmed air with a slow velocity gives the best result.

There should be a separate vertical air duct for every outlet or register. In branched vertical air ducts, one is generally a failure.

The heated air from one heater, may be taken to two vertical air ducts, when they start directly over it; but one should not be taken from the top, and the other from the side; if so, the latter will be a total failure, unless the room to which the flue runs is exhausted: *i. e.*, the cold or vitiated air of the room is drawn out by a heated flue or otherwise.

Inlet or cold air ducts are best when there is one for every coil or heater; and its mouth or outer end, should face the some way as the room to be heated. By this means when the wind blows against that side of the house, the pressure is into the cold air duct, and materially assists the rarefied column of air, in the vertical duct, to force its way into the room.

Often the steam heater uses only one large branched cold air duct; but this system will give trouble unless all the rooms are exhausted.

A steam heater should not take a job of indirect heating unless the building has been arranged especially for it with some efficient system of flues, enough for a total change of air in a given time, say not to exceed one hour.

Ordinarily the architect makes no provision for drawing out the cold or depreciated air, other than an open fireplace, and often they make *no* outlet. Such a room cannot be warmed by indirect heating at all. But when there is a chimney, or an unwarmed outlet or foul air flue, the heated column of air in the vertical hot air flue is generally sufficient to force its way through. Very large rooms with high ceilings are difficult to warm by indirect heating.

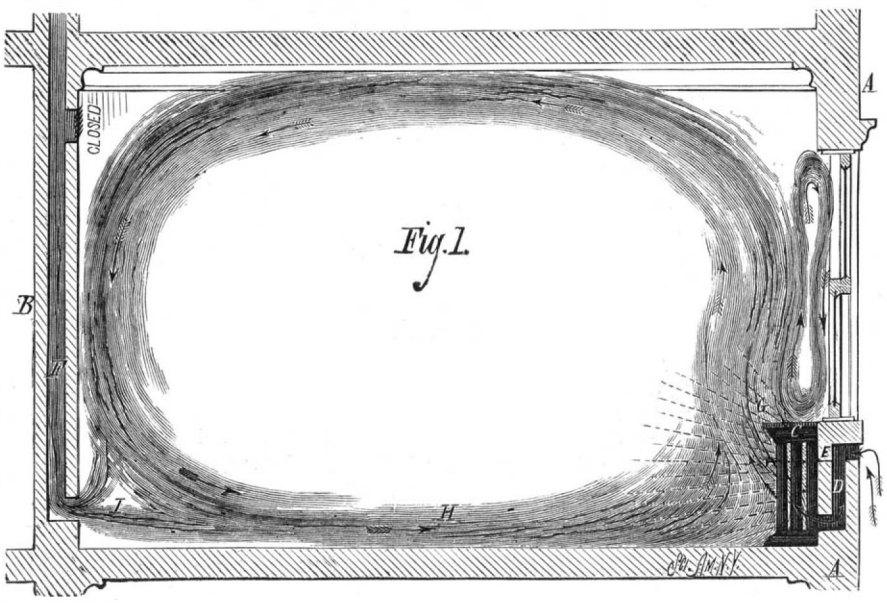

Fig. 1.

DIRECT RADIATION WITH VENTILATION.

A cheap and good way to draw, or exhaust, outlet or foul air flues, is to connect them all to one large annular flue, around the boiler chimney flue.

Warmed fresh air flues, should be in or near the outside walls, and should discharge near the windows; and foul air flues should be in the inner walls, and have an opening near the floor and ceiling, with register valves, to allow the occupant to use either or both as he thinks proper.

To find the time in *minutes*, it will take for a room of known cubical contents, to change its air through a flue of one square foot cross section: Multiply the velocity of the air through the flue in feet per second, by 60, and divide the result, into the cubical contents of the room in feet. Thus: Velocity of air 5 feet × 60 = 300 ÷ into cubical contents, say, 4,000=13·3 minutes.

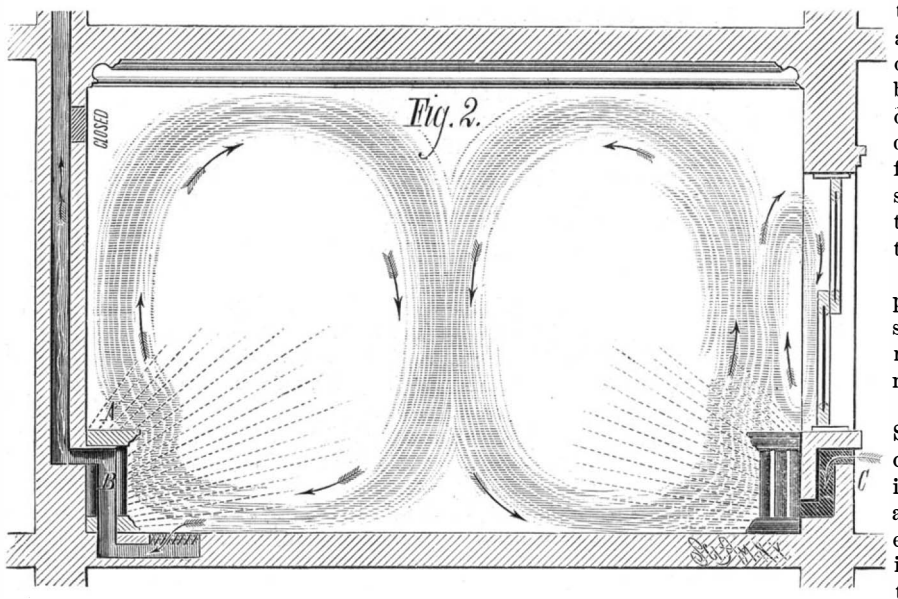

Fig. 2.

MODIFICATION OF DIRECT-INDIRECT RADIATION.

To find the time for other sized flues, multiply the result by the cross section of flues in square feet or fractions thereof.

The velocity of the air in heating flues with only a natural draught, rarely reaches 8 feet per second, no matter what the conditions; and 2 feet, 4·5 feet, and 6·2 feet respectively, being fair averages of velocities for first, second, and third floors of a house.

Direct-indirect radiation embraces all heating surfaces placed within or partly, within the room to be warmed, *in direct connection with some system of ventilation.*

Heaters of this class are usually placed on the outside walls or under windows, following the same general rules as direct radiation, excepting the clusters are deeper, so as to prevent the cold air from rushing through without being warmed.

Fig. 1 shows a much used modification of this style of heating. It is a section of a room showing the action of the currents of air. A A, outside wall; B, partition wall; C, radiator; D, inlet flue; E, damper or valve; F, ventilating flue or foul air outlet; G, fresh air mixing with the air of the room; H, air of the room passing along the floor to the heater; I, a percentage of the air in the room passing off by the ventilator.

Fig. 2 shows another modification of direct-indirect radiation, where some of the *local heat* is employed to exhaust or draw out the vitiated air of the room. The arrows show the action of the air currents. A is a section of a radiator built with a sheet iron flue, B, between the tubes, and passing through a hole, cored in the base, which connects with the register in the floor, and a foul air flue, in the wall.

Some of the radiant heat, etc., from the radiator, A, warms the sheet iron flue, B, which in turn warms the air within it, causing an acceleration of the current in the foul air flue, and consequently drawing an equal amount of fresh air in at the opening, C.

There is this further distinction between the three systems of radiation: Direct radiation warms only the air of the room and maintains the heat. Indirect heating warms only the air that passes in and cannot warm the same air twice, and consequently has to raise the temperature of all the air that passes, from what it is outside, to what is necessary to maintain the temperature of the room, and make up for the loss by ventilation. Direct-indirect radiation warms part of the air over again, and warms all the air there is admitted for ventilation, which latter can be varied to suit the occupants.

NEW INVENTIONS.

Mr. Ole C. Nuubson, of Mount Horeb, Wis., has patented an improved milk cooler, which consists in a milk cooler with trough, gauges, and faucets, and divided into separate chambers by a diaphragm whose central tube extends through the cover.

Mr. Chas. V. Richards, of Skowhegan, Me., has invented an improved clasp, which consists in a case having its edges so arranged as to form jaws, between which a flanged finger piece is pivoted. A wire loop or tongue is adapted to pass through a slot in the case, and has its ends passed through the flanges of the finger piece.

An improved buckle shield, patented by Mr. David Mosman, of New Britain, Conn., consists of a metal plate with curved ends provided with transverse slots and arranged over the buckle, the object being to ornament the harness and to prevent the horse's tail and mane from catching in the buckle.

An improved lubricator, patented by Mr. Oscar A. Rollins, of Campello, Mass., relates to the class of oil pumps designed for supplying oil for lubricating purposes to steam engine cylinders. It consists of an oil forcing piston driven with a intermittent motion by connection with some of the moving parts of the engine.

Mr. John F. Curtice, of Fort Wayne, Ind., has patented an improved device for heating sad irons upon the top of a stove. The invention consists in an improved sad iron heater formed of an open bottomed box divided into compartments by vertical partitions, having the middle part of its top stationary and provided with a handle, and the side parts of its top inclined and formed of doors shutting air tight, or nearly so, and provided with spring catches, to adapt the device for use in heating sad irons upon the top of an ordinary stove.

Mr. Henry S. Kratz, of Chicago, Ill., has patented an improved shelf for attachment to stovepipes for the purpose of supporting culinary vessels, dishes, clothes, or other things requiring to be kept warm or dried.

An improved road-scraper, patented by Mr. Samuel H. Dudley, of Bantam Falls, Conn., consists in the combination of guard bars having their upper ends bent forward at right angles to fit into the notches in the upper edge of the plank, and having sockets formed in their lower parts to receive the rear ends of the draw rods, with the plank, the draw rods and the staples of a scraper.

Mr. Charles A. Gale, of Piqua, Ohio, has patented an improved apparatus for taking solar prints from negatives. The invention consists in the combination of the two frames, hinged to each other at one edge, and provided at the other edge with a bolt and hand nut or equivalent clamp.

Mr. Antoine B. Dembrun, of New Orleans, La., has invented an improved furnace for cooking and baking, and various other uses. It consists in the combination of a furnace, an iron basket, and a hinged grate to form a compact, convenient, and portable furnace.

Messrs. Cornelius Bennett and Parker Burnham, of Silver City, Territory of New Mexico, have patented an improved apparatus for separating gold and other metals from dirt and sediment by what is known as the "dry" process. The invention consists in a combination of devices which cannot be explained without engravings.

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Cost and Results of Some Recent English Strikes.

A writer in *Fraser's Magazine* estimates that the engineers' strike, which began in February last and continued about 33 weeks, caused a loss of $70,000 to the strikers. The average number of men out of employment during this time was 500. If no strike had taken place, their wages would have amounted to $144,000. But they received from society funds about $74,000, reducing their personal loss to $70,000. Of notable strikes that have taken place within the last two years, that of the London masons, which lasted 33 weeks and threw 1,700 men out of employment, cost the strikers about $130,000. The carpenters' strike in Manchester involved about the same number of men, and cost nearly as much. The strike and lockout of the boiler makers and iron shipbuilders on the Clyde cost the society upward of $65,000, the estimated losses being $1,500,000. The losses of the miners in the Durham strike are estimated at $1,200,000. In the above strikes, excepting that of the engineers first mentioned, the strikers suffered disastrous defeats. While strikes are exceedingly expensive luxuries to the men, even when successful, the writer above cited maintains that the number of strikes from which the employes reap no advantage are extremely few, as compared with those from which they derive some benefit, proximate or remote. In illustration of what is sometimes gained by the strikers, he cites the builders' strike and lockout in London in 1859. About 24,000 men quit work, but many of these obtained employment elsewhere. The number engaged in the struggle was from 6,000 to 10,000. The whole number interested in the result of the contest was between 40,000 and 50,000. After spending upward of $250,000, besides the loss in wages, the men were compelled to yield. But they gained the Saturday half holiday, which is now enjoyed by not fewer than 100,000 building operatives. This is computed to be a gain to the men of about $2,800,000 a year, "if not in money, at least in money's worth." The writer claims that the employes get over their losses much more speedily than the employers. With the former, he says, it is a matter of temporary inconvenience, or, at most, of present suffering only; with the latter it means not merely a derangement of business for the time being, but in many cases future embarrassment, if not failure.

The First American Rolling Mill.

Mr. Thomas C. Lewis, of Portsmouth, Ohio, who was formerly an iron roll maker, in a recent letter to the editor of the SCIENTIFIC AMERICAN, states that his father, the late Thomas C. Lewis, was the maker of the first iron rolling machine erected in this country. This mill was put up at Middletown, Pa., 45 miles east of Pittsburg, in the year 1817, for the owners, Mason & Co. Mr. Lewis, Sr., came from Wales in 1815, when our informant was thirteen years of age. Our correspondent thinks that himself and his brother are the only persons now living who witnessed the making of the first bar of American rolled iron. This was the inauguration of what is now one of our most important branches of industry.

NOVEL PEDO-MOTOR.

The annexed engraving represents a new device for accelerating the motion of walking. It seems to occupy an intermediate position between the roller skate and the velocipede.

The invention consists of a frame supported on three wheels, two of which are small and employed only in supporting the main frame of the device, while the third and larger one is used both as a supporter of the frame and a driver of the machine. All of the wheels are furnished with rubber tires, and the larger one is fixed to a shaft extending across the frame and carrying a ratchet, also a loose pinion provided with a pawl capable of engaging the ratchet. A foot pedal is pivoted to the upper part of the pedo-motor frame, and carries a segment rack which engages the loose pinion on the drive wheel shaft. When the toe of the foot pedal is depressed the segment rack, by its engagement with the pinion, turns the drive wheel and propels the machine forward. The motion of the foot necessary to impart a rotary motion to the drive wheel is exactly the same as that of the ordinary act of walking. For checking the motion of the pedo-motor a brake is provided, which is made to press upon one of the smaller wheels by pulling a wire or cord, which extends upward, and is provided with a hook or loop for attachment to some part of the clothing of the user. The pedo-motor is the invention of Mr. Richard Gornall, of Baltimore, Maryland.

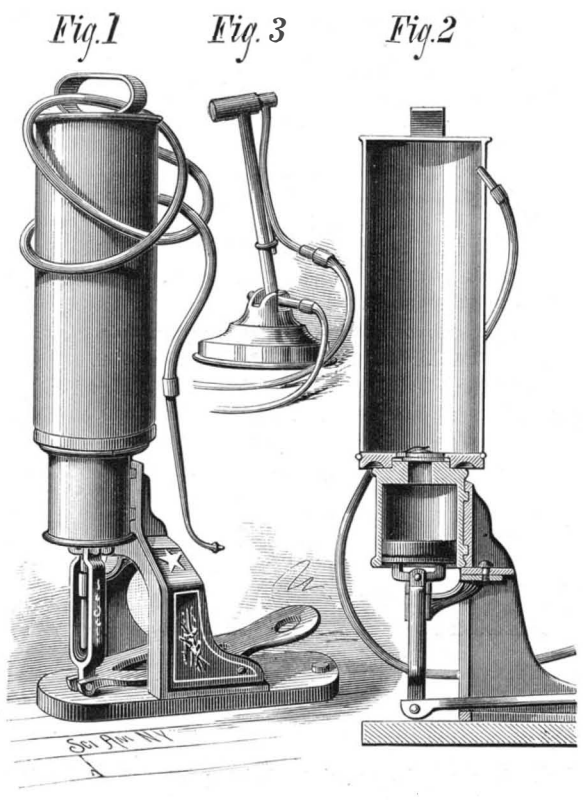
GORNALL'S PEDO-MOTOR.

New Preservative against Scurvy.

In reporting the reception of Prof. Nordenskjöld and the staff of the Vega at Nagasaki, the correspondent of the *North China Herald* notes that there was not a single case of scurvy during the whole voyage. This, he learns, was owing to the free use of a curious little berry that springs out of the eternal ice and snow during the short summer; it bears profusely, and has a taste like the raspberry, but more acid. The fruit is dried, and then mixed with the milk of the reindeer, and it can be ca ried in a frozen state for thousands of miles. There was also used a curious kind of food made from the whale's hide, which is pickled and eaten freely during the winter.

IMPROVED BLOWPIPE.

The annexed engraving represents a compact, simple, and efficient device for maintaining a continuous supply of air under light or heavy pressure for blowpipe use. The advantages of an invention of this character will be readily admitted by any one having had experience with the ordinary mouth blowpipe, as it not only saves a great amount of hard labor, but it delivers a steadier and stronger blast than it is possible to maintain with the mouth, and it also enables the operator to get a better view of his work, and permits of greater freedom in the use of the hands.



BURGESS' PATENT PORTABLE MECHANICAL BLOWPIPE.

The general appearance of the blowpipe is shown in Fig. 1, and its internal construction will be readily understood by referring to Fig. 2, which is a central vertical section. The pump cylinder is mounted on an arched standard, and contains a piston having a valve opening upward. This piston is connected with the foot pedal by a forked connecting rod, and is moved by a slight and easy motion of the foot. The upper end of the pump cylinder is closed, with the exception of a valve aperture, which is covered by a valve, opening upward into a cylindrical air reservoir secured to the upper end of the pump. Near the top of the air reservoir there is a nipple, to which is attached a flexible tube communicating with the blowpipe.

The manufacturers furnish either the ordinary blowpipe or the compound blowpipe, represented by Fig. 3. The machine is light and portable, weighing but twelve pounds and measuring twenty-four inches in height. The pump cylinder is two and a half inches in diameter with three inch stroke.

This device will be invaluable to a large class of artisans, and especially useful to dentists, jewelers, chemists, assayers, metal workers, miners, and others who desire a strong steady blast for reducing, fusing, soldering, etc. It may be used to advantage in connection with the small melting furnaces now so largely in use. It is also of great utility to machinists and steam, water, and gaspipe fitters in making alterations and repairs, as it admits of the local application of a strong heat, and thus obviates the necessity of removing the parts. The blowpipe may be used effectively in connection with a gas, alcohol, or oil flame.

The pipe outlet is much smaller than in the mouth blowpipe, to permit of maintaining a pressure which may be increased or diminished by a quick or slow motion of the treadle. The air chamber is easily filled, and when charged affords a *constant* supply of pure air. It is claimed by the manufacturers of this blowpipe that the pump possesses many advantages over the bellows or bladder, as a pressure of many pounds is readily sustained with but little exertion.

Further particulars may be obtained from J. Elliott Shaw, No. 154 South Fourth street, Philadelphia, Pa.

MECHANICAL INVENTIONS.

Mr. George Stewart, of High Point, N. C., has patented an improved spark arrester. This is an improvement in the class of smoke stacks in which the ascending sparks and cinders are diverted laterally by an inverted cone and strike upon inclined flanges or wings, whereby they are extinguished and pulverized before escaping from the stack.

An improved drilling machine has been patented by Messrs. Nicholas Remmel and Mathias Remmel, of Kewaskum, Wis., for operating drills for drilling holes in metal, and also for holding auger bits and other tools for boring wood. It consists in a drill stock connected with a shaft rotated by a crank or band wheel and gearing and held in a stationary frame, and in a device for feeding the work to the drill by means of a table placed on a shaft held in vertical guides and connected by levers with a treadle.

Mr. Elias A. Wible, of Folsom, Cal., has patented an improved vehicle axle formed of a socketed tube and a wooden stick, in combination with an interposed layer of rubber. There is a hole leading through the axle to the shaft, and provided with a case, a cup, and a screw, for the purpose of lubrication.

Mr. Gustave Wedel, of San Francisco, Cal., has patented an improvement in the class of binders for folios, or a series of detached leaves; it consists of metal strips doubled longitudinally to form lips or clamping edges, between which the leaves are secured.

Mr. John Kenmuir, of St. Joseph, Mo., has invented an improved twelve bells striker for clocks, the object of which is to furnish a clock for use in Masonic lodges, which shall be so constructed that it may be made to strike twelve low bells whenever desired, which will strike at no other time.

Mr. William W. Mackey, of Galion, O., has patented an adjustable gauge for cutting bevels for miter joints with a circular saw, and for cutting them on opposite ends of the moulding without changing the gauge. It consists of two gauges pivoted at one end to the sliding bed on the side next to the saw, and having the opposite ends pivoted to levers or arms having longitudinal slots, which are crossed and secured together and to the bed by a set screw passed through the slots at the junction. These arms are designed to be graduated so as to permit the gauges to be set readily at any desired angle to the saw.

Mr. Richard Cotter, of Virginia City, Nev., has patented a machine for tarring flat and round wire ropes, which is so constructed as to coat the ropes thoroughly with tar, force the tar into the crevices of the ropes, remove the surplus tar, and prevent it from running down the ropes.

Mr. Warren H. Guthrie, of Florence, N. J., has patented an improved screwdriver having a jaw on each side of the blade, the two jaws being connected by a right and left thumbscrew passed through a slot in the blade, whereby the ends of the jaws can be moved to and from the blade, and thus adapted to clasp screw heads of various sizes.

Messrs. William F. Flanagin and Daniel A. Sager, of Pine Wood, Tenn., have patented an improved automatic let-off mechanism for looms, for letting off the yarn from the yarn beam at a uniform speed from the first to the last end of the warp, the speed of the yarn beam being increased in proportion to the decrease of the yarn on the beam.

Mr. Ansel T. Green, of Minneapolis, Minn., has patented an improved belt stretcher. It consists in fixing gear wheels on the heads of the two long side screws of the stretcher, and in arranging two corresponding pinions on a crank rod in such a manner that when the pinions are thrown in gear with the gear wheels both screws will be worked simultaneously; and it further consists of a graduated clamp for the more accurate adjustment of the sides of the belt, of hinged screw sockets for the quicker attachment and removal of the stretcher, and of a thumbscrew nut of novel construction.

Messrs. Jabez C. Terry and Herbert J. Terry, of Springfield, Mass., have patented an improved button lathe designed for turning buttons into finished shape from blanks previously prepared; and instead of operating upon the principle of a cutter formed to suit the pattern of button, it employs a single cutting tool, which, by a variety of adjustments, that may be effected either by hand or automatically, permits the button to be turned and finished according to any desired pattern.

The same inventors have also patented an arrangement of revolving gripes for holding the stock, which are held normally together by spring pressure, but have a treadle connection for separating or retracting them, and a cutter head revolving in a plane at right angles to the plane of revolution of the gripes, or parallel with the axis of the latter, which cutter head is combined also with a treadle connection for causing the cutter head to approach the axis of the gripes at the will of the operator.

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The New Copying Process.

We have heretofore given full directions for the working of this process, which is thus described by Mr. R. H. Ridout in *Nature:*

A very elegant process has recently been introduced into this country for copying and multiplying letters and documents. It is known by various names, according to the etymological skill of the makers. One calls it a "hektograph," another less pardonably calls it the "centograph," while yet another, to bridge the gap between ancient Greek and modern English, styles it the "printograph." But whether it is introduced by these names, or the polygraph, the compo-lithograph, or the velocograph, the principle is the same, though the details are slightly varied in each case. A slab of gelatinous material in a shallow tin tray forms the type. The letter is written with a special ink on any kind of paper, and when dry is placed face downwards upon the jelly, and allowed to remain a minute or more. On removal it is found that the greater part of the ink has been left behind on the jelly. It is only necessary to place pieces of paper on the latter, and on their removal they are found to be perfect facsimiles of the original copy. The number of copies obtainable varies with the ink, the most potent being aniline violet, such as Poirrier's. With this a hundred copies may be produced. Others, such as bleu de Lyon, Bismarck brown, or Roseine,* yield forty to fifty. It was with a view to determine the principles which govern this beautiful process, that I made an examination of the subject. The slab consists of gelatine and glycerine, with carbolic or salicylic acid to prevent fungoid growth, and in the "chromograph" a quantity of barium sulphate is added, which gives the slab a white, enamel-like appearance.

If a hot, strong solution of gelatine in water be prepared † and then a certain quantity of glycerine stirred in, the whole mass will become solid in cooling. This might at first sight appear to be a solution of gelatine in water *and* glycerine; but such is not the case, the gelatine being quite insoluble in glycerine. When the aqueous solution solidifies, the gelatine still retains the water, but the large quantity of glycerine being dispersed through the mass makes the whole into what is practically *a very fine gelatine sponge containing glycerine in its pores.*

The moisture-loving nature of the glycerine prevents the "sponge" from getting dry, while the insolubility of the gelatine in the glycerine prevents its becoming liquid. When the copy is placed on the jelly, the glycerine comes out to meet the ink, for which it has an intense liking. All the suitable inks are freely soluble in glycerine. Some, too, contain acetic acid either in the free state or in combination with bases, as in rosaniline acetate. The acetic acid exerts a solvent action on the gelatine, so that it will be found that after taking off some impressions with an acetic acid ink, as the "multiplex," the jelly will be etched wherever the ink has come into contact with it. As long as any ink remains on the jelly the glycerine will come out of the pores to keep it moist, but when the whole of the ink has been removed the flow of glycerine ceases, and the parts become quite dry. If the ink is not entirely removed by taking a sufficient number of impressions, and the jelly left, after a lapse of twenty-four hours the remaining ink will be absorbed by the jelly. It is necessary, therefore, that the copies should be taken off as soon as possible, so as to avoid the defect caused by the spreading of the ink.

Most of the makers suggest that directly the slab is done with the type should be washed off. The hektograph and most others require that the water should be warm, but the finely divided barium sulphate in the chromograph renders the surface less tenacious, and the impression may be removed with cold water.

Where practicable, it is better in all cases to leave the slab for twenty-four hours, when the old impression will be quite absorbed, and not interfere with a new one.

This gelatine copying process has been received with so much favor by the public that it shows there is a great want for some rapid means of getting a limited number of copies of letters, etc.; and seeing that any number of colors may be used in the original drawing, Mr. Norman Lockyer has suggested that it would be of much use in laboratories for the multiplication of original sketches of biological specimens, and even for spectra charts, and so save much of the time spent in making duplicate copies. The gelatine slab cannot be said to be perfect, as it is liable to be affected by atmospheric changes; but, bearing in mind the fact that the whole is simply a sponge filled with a compound capable of liquefying certain inks, it is reasonable to hope and expect that chromography is only the pioneer of a process which shall possess all its advantages and none of its defects.

The Fire Laws of Japan.

The severity with which persons in Japan are punished who have the misfortune to be burned out is stated as follows: If the house is unoccupied and is accidentally set on fire, the person through whose carelessness the fire is started receives ten days' imprisonment with hard labor; if it is inhabited and the fire be produced by the proprietor, then he is punished with twenty days; if the fire spreads to other houses the sentence is forty days, and when anybody is killed thereby, one degree heavier; but if the person killed is a relative of the first degree, the punishment is one hundred days; if the house belongs to the government, one hundred days; if a temple, from sixty days to one year, but ten years are inflicted if it happens to be one of the great temples of Isle, or in the precincts of the Imperial Palace. If a robber sets fire unintentionally to a house, he is punished with, at least, three years' imprisonment with hard labor. Decapitation awaits incendiaries, ten years' penal servitude an attempt at arson; the punishment being mitigated if the would-be incendiary is a servant who has just received a sharp rebuke, or if the attempt be made on an uninhabited dwelling. If a man sets fire to his own house, ninety days, but if the fire spreads to houses in the neighborhood, two years and a half; and penal servitude for life is inflicted if the offender profits by the opportunity of the fire to purloin goods or property.

* A very potent and easily prepared ink which will yield a hundred copies may be made by dissolving rosaniline in a cold saturated solution of oxalic acid. It must be allowed to dry spontaneously.

† 4 oz. gelatine dissolved in 6 oz. water, and 20 oz. glycerine, sp. gr. 1·26, previously warmed, stirred in. Any air bubbles in the gelatine are removed before the addition of the glycerine. A cheaper compound, which answers equally well, but is rather darker, consists of Scotch glue, 6 oz.; water, 8 oz.; glycerine, 20 oz. These quantities make a slab 10 × 13 × ¼.

IMPROVED DRAUGHT TUG SPRINGS.

The accompanying engravings show two forms of draught tug springs patented by Mr. R. W. Smalley, of Salem, Mass. These springs are intended to relieve the horse from sudden jerks and strains in drawing a load over a rough road, and also in starting heavy freights, saving a great percentage of power and often preventing the horse from balking.

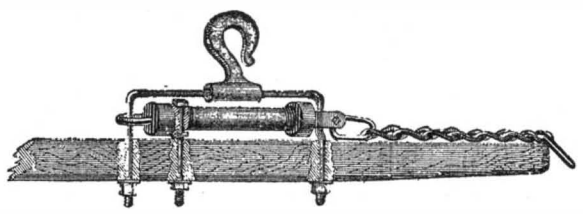

Fig. 2.—SMALLEY'S DRAUGHT TUG SPRINGS.

Fig. 1 shows the device, with a portion of the spring case broken away to show the internal construction. Fig. 2 shows the application of the device to short tugs, such as are commonly used on drays. The invention consists in a barrel or spring casing, having at one end a hook, and containing a strong, double steel spring which surrounds a rod extending through the end or the casing opposite the hook. This spring presses against a nut and washer on the inner end of the rod. When the springs are used in connection with traces, the hooks engage the ends of the whiffletrees, and the opposite ends are secured to the traces. When the springs are used in connection with short traces or chains they are arranged as shown in Fig. 2; the iron staple being made high enough to allow the back-chain hook to move freely.

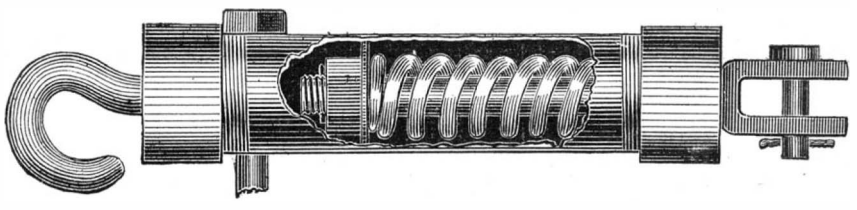

Fig. 1.—SMALLEY'S DRAUGHT TUG SPRINGS.

Any one having regard for the welfare of his horses, or the durability of his harness and carriage or wagon gear, would do well to examine this device, as it assists greatly in starting and drawing heavy loads, prevents galling the horse's shoulders, saves tug straps, and relieves the running gear of wagons and carriages of a great deal of strain.

COMBINED MILK STRAINER AND STOOL.

The accompanying engraving represents a combined milk strainer and stool invented by Mr. G. B. Valentine, of Shepardsville, Clinton county, Mich. The design of the invention will be at once understood by reference to the engraving. The milk pail is provided with a cover which excludes dirt and dust, and at the same time converts the pail into a stool for the milker. A tube extending from the pail cover supports a strainer which receives the milk as it is drawn from the cow and prevents the entrance of dirt or dust to the pail, and the milk is conveyed to the pail in a clean and wholesome condition. The accidental overturning of the pail, so common to the ordinary methods of milking, is not likely to occur when this device is used.

VALENTINE'S MILK STRAINER AND STOOL.

MISCELLANEOUS INVENTIONS

An improvement in horse powers, patented by Messrs. Elijah Wade and William McAulay, of Quitman, Ga., consists in a novel arrangement of a tongue and double tree, in combination with the sweep or lever of a horse power, whereby greater leverage may be obtained within a given circle.

An improved tire fastening for vehicle wheels has been patented by Mr. Chauncey H. Starkey, of Colorado Springs, Col. The object of this invention is to provide a simple and effective means for fastening the tires and fellies of vehicle wheels together, so that the tire will not slip off from the contraction of the wood. This dislocation of the tire is of frequent occurrence, and as it generally results in the breakage of the wheel, it is a very serious difficulty, and is especially embarrassing when it happens to loaded wagons in the western country, where opportunity for repairs exist only at long intervals.

An improvement in advertising frames, patented by Mr. Emory J. Morrell, of Petrolia, Ontario, Canada, consists of a center post or standard, on which are set two broad collars, one below the other, from which radiate arms that support on their forward ends upright boxes, the faces of which are each of them divided by vertical strips into three sections, provided with glass fronts, through which may be seen the business cards, etc., that are placed within. Over each column or section will be placed the name of the business represented by the cards below.

An improved road scraper, patented by Mr. Samuel H. Dudley, of Bantam Falls, Conn., consists in the combination of guard bars having their upper ends bent forward at right angles to fit into the notches in the upper edge of the plank, and having sockets formed in their lower parts to receive the rear ends of the draw rods, with the plank, the draw rods, and the staples of a scraper.

Mr. Alfred R. Garver and Haney Hemenway, of Colorado Springs, have patented an improved wire-stretcher, which consists in combining a spring having a pawl and a T-lever with ratchet on the spool, and in combining with a frame having a slot at one end, and a median spool, a ribbon of metal, and a head, to connect the spool and gripers.

An improvement in grain-separators has been patented by Mr. Alexander Fugel, of Clayton, Cal. The invention consists in a novel means for imparting motion to the upper and lower shoes of a grain-separator.

Mr. William H. Allen, of New York city, has patented an apparatus for weighing grain, flour, and other similar substances as they flow from a spout into a hopper or other receiver. It is so constructed as to deliver the substance in exact and uniform quantities, and at the same time accurately register the quantities delivered.

Mr. George Wood, of Trenton, N. J., has patented a simple, convenient, and effective machine for removing corn from cobs. It is so designed as to take off the pulp and leave the hulls.

Mr. William T. Bradberry, of Allegheny, Pa., has patented an improved combined fire screen and blower, which, when the device is not in use as a blower, may be lowered and used as a fire screen.

Mr. John Decker, of Ogdensburg, N. J., has patented an improvement in burglar alarms, consisting of a sliding match carrier and a weight so arranged and connected with a door or window that when the door or window is opened the weight falls and gives a sufficient alarm, and at the same time causes a match to be lighted on a friction surface and to be moved to and light a lamp. The device may be connected to one or more windows or doors.

Messrs. Partrick J. Clark and Joseph Kintz, of West Meriden, Conn., have patented an improvement in extension chandeliers. This invention relates to chandeliers that are fitted with telescopic joints, so that the lower portion, carrying the burners, may be raised and lowered on a fixed rod attached to the ceiling.

Mr. Edward Edwards, of South Charleston, Ohio, has patented a strong, easy, and convenient seat or range of seats for halls, opera houses, etc., consisting of several upright side frames rigidly held by iron rods that support the seats. The seats have a strong bracing strip running across and secured to the hind legs.

Mr. Azell N. Rouech, of Bay City, Mich., has patented an improved cup, such as are used on billiard tables for holding chalk for application on the tips of billiard cues, the object being to make convenient the chalking of the cue without handling the chalk, and to keep the chalk and the cup from rattling and shaking at the concussion of the balls with the cushion of the table.

Mr. Marshall J. Hughes, of Jersey City, N. J., has patented an improved stereotype casting box. This is an important improvement, and dispenses with the spacing blocks previously employed, and clamps or secures the side bars at any desired distance apart very quickly and easily. It also permits of inserting or removing the mould with much less difficulty and labor and in a shorter time.

Messrs. Henry B. Andrews and Oscar W. Ball, of Faribault, Minn., have patented a machine for pressing the axle boxes into the hubs of wheels. It consists in the combination of a bed plate or frame, having a large hole or opening through its center, a detachable plate, having a hole through its center to receive the end of a hub, and stationary uprights, supporting a detachable crossbar having a lever, and the lever for pressing the box into the hub.

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AMERICAN INDUSTRIES.—No. 30.

THE MANUFACTURE OF LEATHER BELTING.

The use of leather belts or bands for the transmission of power in driving heavy machinery is a comparatively modern innovation. It was a "Yankee idea," as the phrase goes, and this method of conveying power has been adopted in this country to a far greater extent than anywhere else in the world. In England, whose pre-eminence in nearly all branches of manufacture has always been so marked, the possibility of using leather belts to run heavy machinery was for a long time scouted, and it is only within a few years that some of the largest mill owners there have practically conceded the advantages of this method. To run small machines, where but little power was required, bands made of different substances had long been used, but where a great amount of power was to be employed, cog wheels or gearing was thought to be absolutely indispensable. It was expensive to fit up machinery to run with cogs and gearing; there were many breakages, involving interruption to work as well as costly repairs, and a great amount of power was always lost in friction; but it had become a fundamental idea of the English mechanic that this was the only "sure" method of conveying power in a large way. We have even known of instances, within the past ten years, where owners of extensive factories in England could not believe it possible that machinery requiring as much as 300 horse power could be run without the use of cog wheels or gearing, until the driving power had been several times divided up, and have been witnesses of their astonishment at seeing one leather belt regularly transmit what was estimated as 800 to 1,000 horse power. A large portion of the manufacturers in England and on the Continent of Europe still use gearing for work in which its employment would not be for a moment thought of in this country, but its use is now rapidly giving way before the proved advantages of what may be truly called the American system.

The manufacture of leather belts as a distinct branch of business was first commenced about the year 1825, by a New York leather merchant, who occupied for that purpose the lofts of a store in Ferry street. Previous to that time it was customary for machinists to fit up their own belting, buying the leather in the side or whole hide, and cutting and joining the lengths. As the "stretch" had not been taken out of the leather, the belt so made would constantly need "taking up," and as the hide had not been especially selected for this purpose, and the makers generally knew but little of the differences in the quality of the leather in different portions of the hide, it was seldom that a belt would run true without twisting. When, however, a good mechanic, who had also a tanner's acquaintance with the differences in leather, undertook to manufacture belts, there was not only a wonderful improvement in their wear and the amount of work which small belts would do, but the first step was taken toward so extending their use that they could take the place of gearing in running heavy machinery. The business was of slow growth at first, however, and it was several years before the "ready made" belting came into general use.

Among the earliest to perceive the large field offered by this new specialty was Pliny Jewell, of Hartford, Conn., the founder of the house of P. Jewell & Sons, whose extensive factory for the manufacture of belting furnishes the subject for the illustrations on the first page of to-day's paper. Mr. Jewell had been a tanner, but, in 1849, determined to commence the manufacture of leather belting, and in connection with his son Marshall, founded the house of P. Jewell & Son. Three other sons were afterward admitted—Pliny, Charles A., and Lyman B.—constituting the firm of P. Jewell & Sons, which style has since been maintained, although the father has been dead several years. Besides being energetic and thoroughly wide-awake business men, they were a family of tanners, and therefore had the best of preparation for making a success in what was then a comparatively new business. The use of leather belts rapidly increased, and the business was soon greatly enlarged, and it was only a short time before the goods manufactured by this house were to be found in the factories of every State in the Union. The firm have not been content to stop here, however, but for some years past they have exported and sold large quantities of belting to European mill owners, and the demand for belts of their manufacture, from the foreign as well as the home trade, is constantly increasing.

The belt factory of P. Jewell & Sons, at Hartford, is a five story building, 185 feet long by 44 feet wide, with an L three stories high. The leather from which the belts are made comes to the factory direct from a large tannery in Michigan owned and operated by the firm. The leather all comes "in the rough," as it is called, that is, it is only tanned and dried, but is in no way finished at the tannery. The first operation to which it is subjected after coming to the factory is the scouring, as shown in the upper right hand sketch. Thorough scouring is one of the indispensable requisites in good belt making, for by this operation the "bloom" from the bark liquors, with other coloring and resinous matters, not actually adding to the strength of the leather, are washed out. For this purpose the leather, having been thoroughly wet, is placed—either a whole or half hide, as may be desired, at a time—upon the movable bed of the scouring machine, which may be easily and quickly moved from side to side, or forward and backward, as necessary. Over this bed, and attached to an arm from a shaft, is a sort of box, in which are fixed scouring stones similar to those used by curriers. There are two of these stones, one in each side of the box, and as the arm moves forward one of them makes a stroke on the leather, while with the backward movement the other gives a similar stroke. These stones are accompanied by stiff brushes, a small jet of water being at the same time constantly directed to where the stoning and brushing are being done. The workman is all the time moving the table on which the leather is spread out, so that this scouring may be effected on every portion, and he can make the strokes of any desired force. This machine will do as much scouring as it would be possible for three or four men to do by hand, and it is thought to do the work far better for leather to be used in making belts, as the powerful strokes it gives are very effectual for the thorough "setting out," or smoothing of the leather, making it to lie flat and even.

The illustration to the left of the scouring room shows the workmen engaged in cutting up the leather, all wide belts being cut from the middle of a whole hide, and each width of belt having an especial part of the hide from which it is most desirable to cut it.

The "stretching," as shown in another sketch, is of especial importance in the making of a belt which is expected to run without giving trouble, for the necessity of having frequently to "take up" belts which stretch so as to become too loose is a serious inconvenience in a factory, where, oftentimes, a number of hands must stand idle until the difficulty is remedied. The stretching is accomplished by making fast each end of a piece of leather in clamps, then, with a lever, putting on all the strain which the leather will bear, and allowing it to stand under this strain for several hours. In this way the stretch is generally so well taken out that a new belt, where it has been properly put up, may often be run for months without requiring any attention.

The "jointing" and "cementing," as shown in another sketch, embrace departments of the business which formerly received very little attention, but are now recognized as of great importance. In the jointing, the ends having been made perfectly square, they are beveled and skived down, so that, where the laps occur, the belt shall be of an even and uniform thickness, and the fitting as nice and true as if the whole belt were cut out of one piece of leather. It is especially important that this work be well done, for the smoother the surface of the belt is made the less air will pass under it and between it and the pulley, and the closer the contact of the belt and pulley the more machinery will the belt drive. The cementing of these ends or laps together is said to contribute much more to the strength of the belt than the riveting, and we have seen tests of belting, in which only cement was used for fastening the different lengths, where the leather gave way at other places rather than where the joint was made.

The room devoted to riveting and finishing is shown in the large engraving at the bottom of the page, which gives a good idea of the extent of the business, and the methodical manner in which it is conducted.

It is impossible, however, to make good belts without having a first-rate selection of just the right kind of leather—to obtain which the hides should be selected and the tanning operation conducted with that end in view. The Messrs. Jewell have a large tannery in Michigan, with a capacity for tanning 50,000 hides a year, which they run for the especial purpose of giving them just the kind of leather they use in their belt factory. It is located where there is an abundance of bark, and where the choicest hides for belting are to be had, namely, those from the grass-fed prairie cattle. These hides are, as a rule, superior to those taken from the stall-fed cattle of the Eastern States, the fiber of the hide being more compact and solid, and making leather less liable to stretch than any other. The tanning process is not hurried, as it is in many cases with sole leather, and no hides are "worked in" which have any brands or cuts that would injure a belt. The best hides for this purpose are those from cattle four or five years old, as the hides of animals of that age have not been repeatedly stretched and shrunken, from changes in their condition, as is often the case with older ones, and the leather made from such hides is more likely to permanently remain straight. "I give it as my judgment, after thirty years of observation and experience," says the Hon. Marshall Jewell, from whom most of the above facts have been obtained, "that the best and cheapest belt in the world is one made from the hide of a four or five year old bullock that has been fed on grass, the hide being tanned thoroughly with bark, and a long time given to the process, and the belt then being run with the grain or hair side to the pulley."

It would be strange, however, in a business of such magnitude as the belt manufacture has now become, and which has attained its present proportions so recently, if there were not many competitors in the field now principally occupied by leather belting. India rubber and gutta percha, and canvas, or one of the former in combination with the latter, are extensively used in out-of-door work and in wheel pits, or where the belts are constantly exposed to water, and for such work they serve a good purpose. In Europe there is a great variety of cheap belts, one kind consisting of refuse pieces of leather wired together. Belting is also made there of a species of Helvetia leather, so little tanned that it is here called rawhide; it is light, strong, and tough, but stretches easily, and is not as serviceable as are belts made of bark-tanned leather. The rawhide belting occasionally used here has something of the same characteristics. Many attempts have also been made to utilize metal in the manufacture of belts, but none of them have thus far met with any considerable success. A belt of this kind was brought forward in Russia some years ago, consisting of a chain whose links were locked together by small rods. Mr. Jewell, while Minister to Russia from the United States, negotiated for the control of the patent for this country, and put some of this belting in use on his own machinery. It was found, however, that this chain belt never got through stretching; the links became flattened and wore into each other, so that the belt lengthened a little every day, and, during the year in which it was in operation here, it had to be "taken up" as often as once a week, to the great annoyance and inconvenience of all who were dependent on it in their work. On a visit last year to the factory where it was manufactured, in St. Petersburg, Mr. Jewell found that its use had been abandoned for the above reasons. Notwithstanding, therefore, all the efforts which have been and are being made to introduce other kinds of belting, experience has thus far proved that bark-tanned leather makes the best, and, for most purposes, the cheapest article furnished, when its perfect reliability and the amount of wear it will give are taken into consideration.

The Hon. Marshall Jewell.

Perhaps it is proper, in concluding this sketch of the leather belting manufacture, as conducted by one of the representative firms in that line of business, to give some of the principal facts in the life of the gentleman who is now at the head of the firm, who was in the house at its commencement, and who has, besides taking an active part in this way in the industrial progress of the country, filled several prominent positions in public life. Marshall Jewell was born in Winchester, N. H., October 25, 1825. For five generations back the Jewells had been tanners, and young Marshall, after receiving a common school education, supplemented by a few terms at the village academy, commenced learning his trade in his farther's tanyard. He afterward learned the business of currying, or the finishing of upper leather, and then, with the disposition for change so common with boys, drifted westward, and became engaged in the telegraph business, when that specialty was still in its infancy. He was for a while in the offices at Rochester, N. Y., Akron, O., Columbia, Tenn., and Jackson, Miss., and, in 1849, received an offer of the superintendency of the New York and Boston Telegraph Line, which he came North to accept. On reaching Hartford, however, he found his father started in the manufacture of belting, and, abandoning the telegraph business, cast in his fortunes with him. Mr. Jewell visited Europe in 1859 and in 1860, and again in 1865, when he spent a year abroad, visiting Asia and Africa; he also attended the French Exhibition of 1867, and in each of these visits he did good work, either in the way of extending the trade of his firm, or in gleaning information that would be of value in the prosecution of his tanning and belting business.

In 1868 Mr. Jewell's name was first brought forward in a political canvass; he was nominated for governor of Connecticut. Four times afterward he ran for the same office, during periods of great excitement and when the personal character of the nominees was subjected to the closest scrutiny, and was thrice elected, thus being successful in the race three times out of five in five successive years. In 1873, just after he had retired from the governorship, he was appointed United States Minister to St. Petersburg. While there he found that many fraudulent imitations of American manufactures were being sold, notably in sewing machines, Fairbanks' scales, Collins' axes, etc., all of which were being palmed off as of American make. He at once commenced negotiating a trade mark treaty with Russia, which was speedily concluded and ratified, by which American interests in goods covered by trade marks were protected. He also, at the especial suggestion of Mr. Jackson S. Schultz, made a careful investigation by which he discovered the process of making the peculiarly scented Russia leather, which had theretofore been made only in Russia, the means by which this particular odor was imparted to the leather having been kept secret. He found that the manufacture and coloring were carried on according to substantially the same principles as those followed here, but that the aroma was given to the leather by the use of a small amount of birch bark tar, some of which he purchased and sent to New York. Since that time American manufacturers have made "Russia" leather as good as any that was ever made in Russia; they have also made a good deal which was greatly inferior, but the poor as well as the good have had what is called the "genuine Russia smell," so that this no longer affords a criterion by which to judge of the quality of the leather or the place of its manufacture.

On the 1st of July, 1874, President Grant invited Mr. Jewell to return and take a place in his Cabinet as Postmaster General, which position he assumed on the 1st of September following. During his administration of the office, "straw" bidding, which had become a great evil in the department, was suppressed, and the general efficiency of the postal service was greatly increased. He also negotiated a postal treaty with Canada, whereby the postage between the two countries was made the same as between different offices at home. Mr. Jewell retired from the Cabinet July 14, 1876, since which time he has given his attention entirely to the business of his firm.

Notes on Belting.

We think it would be greatly to the advantage of mill-owners, dyers, finishers, etc., if everybody who supplied them with machinery and other goods would imitate more largely the example taken by Messrs. S. E. Morris & Co.,

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as regards their belting, in giving precise instructions respecting the employment of such machinery or goods. Without holding ourselves responsible for the following notes on belting, we are glad to find space for them, as embodying the result of the experience of a firm who have had much to do in the matter. They say: The formula given below is based on the experience of engineers in Great Britain, America, and France. It serves the purpose of showing what width of belt will do the required work most efficiently, and at the same time last the maximum number of years. Many engineers, more especially in this country, are content to provide belts of greatly reduced width, and of single substance instead of double; hence the frequent complaints of their stretching, breaking, and lasting so short a time. As a matter of convenience and arrangement of machinery, a narrower belt than that which is shown by the generally accepted formula is often imperative; but, in the absence of any such conditions, it is questionable economy to depart materially from it. The following may be regarded as an axiom: To use a belt of ample width and substance for the work required is to secure for it a long existence, with satisfaction to all concerned.

Directions for Calculating the Width of Belts Required for Transmitting Different Numbers of Horse Power.

Multiply 33,000 by the number of horse power to be transmitted; divide the amount by the number of feet the belt is to run per minute; divide the quotient by the number of feet or parts of a foot in length of belt contact with smaller drum or pulley; divide this last quotient by six, and the result is the required width of a single tanned leather belt in inches.

Explanations.—The figures 33,000 represent the number of lb. a horse is reckoned to be able to raise one foot high in a minute. To obtain the number of feet a belt runs per minute, find the number of revolutions per minute of the driving shaft and multiply by the circumference of the drum, which is always 3·1416 its diameter. The final division by six is because half a pound raised one foot high per minute is allowed to each square inch of belting in contact with the pulley; a pound must therefore be allowed to two square inches, or six pounds to a strip one foot long and one inch broad.

Example.—Required the width of a single belt, the velocity of which is to be 1,500 feet per minute; it has to transmit 10 horse-power, the diameter of smaller drum being four feet, with five feet of its circumference in contact with belt:

$33{,}000 \times 10 = 330{,}000 \div 1{,}500 = 220 \div 5 = 44 \div 6 = 7\frac{1}{3}$ inches, the required width of belt.

Directions for Calculating the Number of Horse-power which a Belt will transmit.

Divide the number of square inches of belt in contact with the pulley by two; multiply this quotient by the velocity of the belt in feet per minute; again divide the total by 33,000, and the quotient is the number of horse-power.

Explanations.—The early division by two is to obtain the number of lb. raised one foot high per minute, half a pound being allowed to each square inch of belting in contact with the pulley.

Example.—A six inch single belt is being moved with a velocity of 1,200 feet per minute, with four feet of its length in contact with a three foot drum. Required the horse-power:

$6 \times 48 = 288 \div 2 = 144 \times 1{,}200 = 172{,}800 \div 33{,}000 =$ say $5\frac{1}{4}$ horse-power.

It is safe to reckon that a double belt will do half as much work again as a single one. Belting made from "Helvetia" leather is much stronger and will bear a heavier strain than that made from ordinary tanned leather.

Hints to Users of Belting.

1. Horizontal, inclined, and long belts give a much better effect than vertical and short belts.

2. Short belts require to be tighter than long ones. A long belt working horizontally increases the grip by its own weight.

3. If there is *too* great a distance between the pulleys, the weight of the belt will produce a heavy sag, drawing so hard on the shaft as to cause great friction at the bearings; while at the same time the belt will have an unsteady, flapping motion, injurious to itself and to the machinery.

4. Care should be taken to let belts run free and easy, so as to prevent the tearing out of lace holes at the lap; it also prevents the rapid wear of the metal bearings.

5. It is asserted that the grain side of a belt put next to the pulley will drive 30 per cent. more than the flesh side. Experience can alone verify this; but when belts are required to be worked this way, the fact should be stated in the order, so that the riveting may be arranged accordingly.

6. To obtain a greater amount of power from belts, the pulleys may be covered with leather; this will allow the belts to be run very slack, and give 25 per cent. more durability.

7. Leather belts should be well protected against water and even loose steam or other moisture.

8. Belts working in very wet places should be ordered to be waterproofed.

9. A careful workman will see that his belts are redressed about every four months, by sponging the dirt from them with warm soap and water; then drying with a cloth, and, while still damp, rubbing in castor oil or currier's grease, which will be readily absorbed, the leather being moist from washing. Castor oil has the additional advantage of preventing rats attacking the leather.

10. In putting on a belt, be sure that the joints run with the pulleys, and not against them.

11. In punching a belt for lacing, it is desirable to use an oval punch; the larger diameter of the punch being parallel with the belt, so as to cut out as little of the effective section of the leather as possible.

12. Begin to lace in the center of the belt, and take care to keep the ends exactly in line and to lace both sides with equal tightness. The lacing should not be crossed on the side of the belt that runs next the pulley. Thin but strong laces only should be used.

13. It is desirable to locate the shafting and machinery so that belts shall run off from each other in opposite directions, as this arrangement will relieve the bearings from the friction that would result where the belts all pull one way on the shaft.

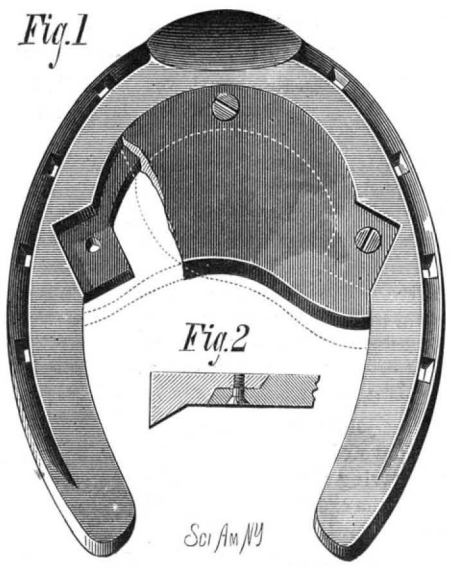
14. If possible, the machinery should be so planned that the direction of the belt motion shall be from the top of the driving to the top of the driven pulley.

15. Never overload a belt.

16. A careful attendant will make a belt last many years, which through neglect might not last one.—*Textile Manufacturer.*

NEW WEIGHTED HORSESHOE.

The annexed engraving represents an improved weighted



SEIXAS' WEIGHTED HORSESHOE.

horseshoe invented by Mr. Eugene E. Seixas, of Galveston, Texas. The improved horseshoe is designed to be used in training horses to trot rapidly by causing him to extend his strides. It squares his step, and may be used for preventing him from striking his knees with his feet.

In the engraving a part of the weight is broken away to show the form of the shoe under the joint, and Fig. 2 is a section of a portion of the shoe and weight taken through the joint. The weight is fitted to a rabbet or recess formed in the shoe, and is held in place by three screws, so that it may at any time be removed if required.

When it is necessary to use the device for preventing the horse from striking his knees with his feet the weight is made to extend farther back upon one side than the other, as shown in the dotted lines in Fig. 1.

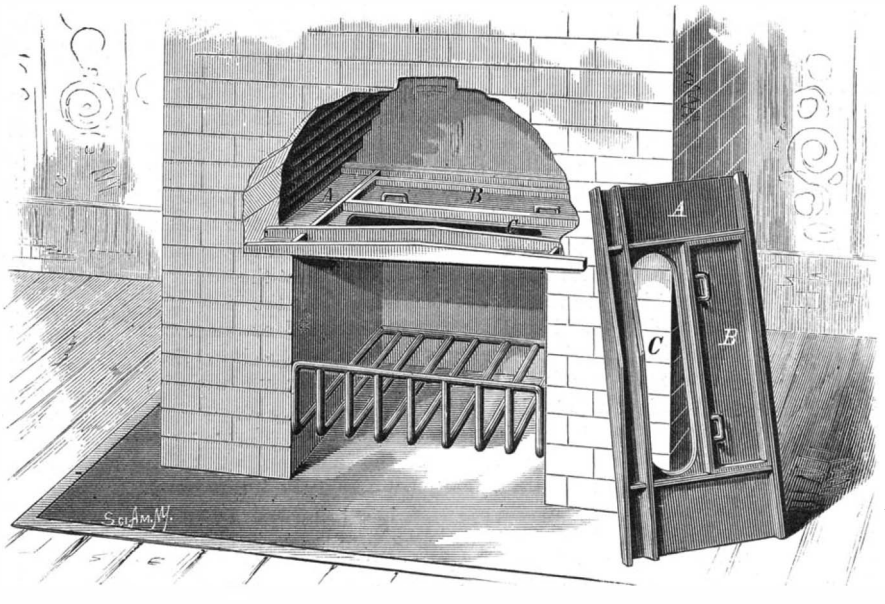
IMPROVEMENT IN FIREPLACES.

The annexed engraving represents an improved fireplace damper plate and arch bar recently patented by Mr. Clark Hanes, of Wheeling, West Va. It serves the purpose of an arch bar for sustaining the brick wall over the fireplace, opening also as a damper for regulating the draught and for preventing the falling of soot when the fireplace is not in use.

The engraving shows the plate and damper in position in the fireplace, and also gives a face view in perspective.

A is a cast iron plate of sufficient length to rest on the walls at the side of the fireplace, and having the oblong aperture, C, which is sufficient for the escape of smoke. A damper, B, fitted between two ribs on the plate, A, is capable of being moved so as to cover the opening, C. The plate is ribbed to give it sufficient strength to sustain the weight of the wall above the fireplace, and thus obviates the necessity of building an arch for that purpose.

This invention facilitates the construction of fireplaces, and renders them free from one of the principal objections brought against them, that is, the escape of soot through the flue opening into the room when the fireplace is not in use.



FIREPLACE DAMPER PLATE AND ARCH BAR.

RECENT INVENTIONS.

Mr. Solomon B. Ellithorp, of Rochester, N. Y., has invented an improvement in waxing mechanisms for sewing machines. It consists of two arms carrying sponges, which are moved reciprocally by the operating mechanism of the machine in such a manner that they pass over melted wax held in a suitable receptacle, taking up a suitable quantity thereof, and at the proper time are rubbed and clasped against the two threads carried by the needle and shuttle.

An improved cord adjuster has been patented by Mr. William W. Batchelder, of New York city. The object of this invention is to furnish cord adjusters and holders so constructed that cords may be moved longitudinally through them as required, and may be held securely in place when adjusted. It consists in a cord adjuster and holder formed of a tube having longitudinal flanges or ribs upon its inner surface, an interior swiveled spiral and a swiveled collar, so constructed and arranged that the cord may be moved longitudinally by turning the collar.

Mr. Alfred E. Feroe, of Tivoli, N. Y., has patented an improved process of obtaining wort, which consists in first dissolving the diastase of the ground malt in warm water at less than a converting temperature, and then bringing the mash to and keeping it at a converting heat by continuously drawing the wort from the bottom of the tub, heating, and passing it through the mash, as specified.

Mr. Edward Earle, of Brooklyn, N. Y., has patented an improved fishing rod which consists in providing the ordinary ferrules or tubes that are fitted to slip together with an annular cap or socket piece that covers the end of the outer tube and prevents water from working in and rotting the rod.

Mr. Charles J. Everickx, of Paris, France, has patented a system of articulation or joints for portable furniture, so that it can readily be folded up to occupy a very small space and can be conveniently carried.

New York City Fire Department.

The statistics of the Fire Department show that there were 1,541 fires in the city in 1879, against 1,655 in 1878. In 1877 there were 1,450. The only printed statistics with which these can be compared are those of the first three years of the existence of the paid department—1866, 1867, and 1868—when there were 798, 873, and 740 fires respectively. The increase in number of fires is accounted for by the increase of the city and the addition of such districts as Westchester to the area covered by the statistics. The higher efficiency of the Fire Department is indicated in the fact that while the percentages of total destruction of buildings by fire were 7, $6\frac{1}{2}$, and 5 per cent for 1866, 1867, and 1868 respectively, the percentages for 1877, 1878, and 1879 were only 3·45, 1·14, and 1·6 per cent of total loss. This difference is said to be due to the perfected system of fire alarms now in use; the convenient arrangement of quarters for men and horses, insuring the promptest response to the signals, and the introduction into the city of a large number of new hydrants, which have always been erected as soon as the Commissioners requested them.

The principal causes of fires have been carelessness on the part of servants or occupants of houses (this is accountable for nearly one-quarter of all the fires), foul chimneys, explosion of kerosene lamps, and window curtains near gas jets. The number of fires from kerosene has been reduced from 136 in 1877 to 92 in 1879, by the methodical inspection of the oil offered for sale, and the regulation of its quality and of the quantity kept in store. Men are constantly employed in collecting samples, which are labeled and tested, and the dealer is attended to if his sample is below the standard fixed by law. The dealers are getting to understand that they cannot keep an inferior oil without detection, and the consequence is that there is seldom any offered for sale that is not of good quality.

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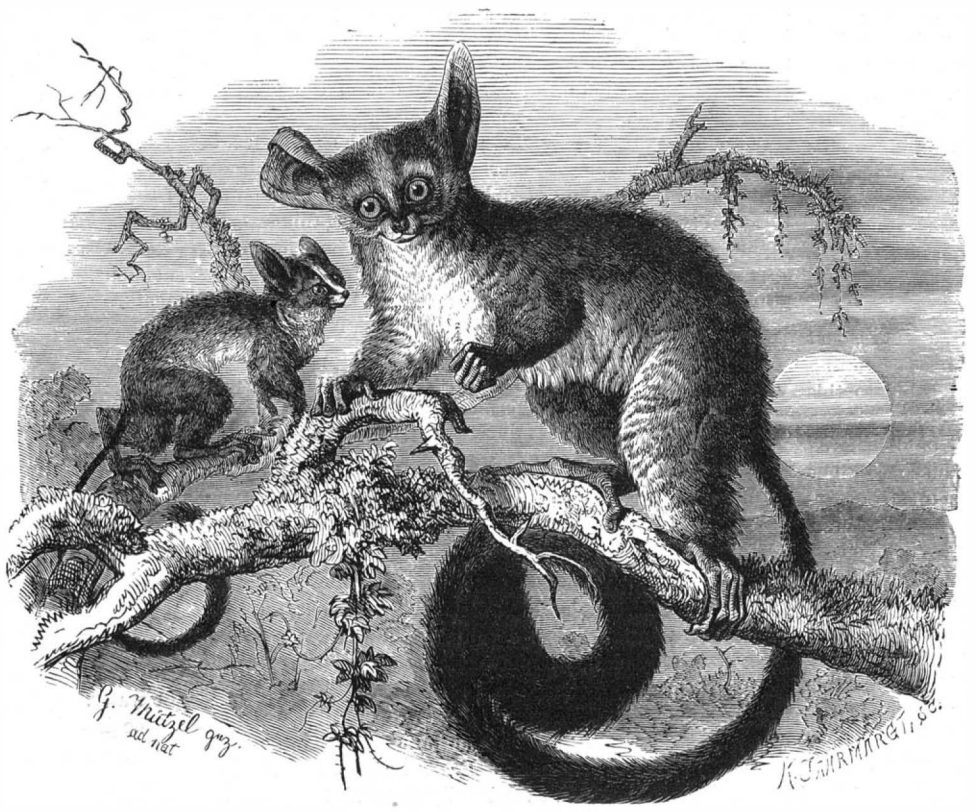
THE MOHOLI GALAGO.

The moholi galago is nearly sixteen inches in length, inclusive of the tail. Its color is gray, with irregular markings of a deeper hue. The under parts of the body are nearly white, and the limbs are slightly tinged with a golden luster. The tail is not very bushy, excepting at the extremity, and its color is a chestnut brown. The texture of the fur is very soft, and there is a slight wooliness in its setting.

Nocturnal in habits, it sleeps during the day, with its large ears folded over the head in such a manner as to give it the aspect of an earless animal. More active than the loris, the moholi does not secure its prey by stealing on it with slow and silent movements, but leaps upon the flying insects on which it loves to feed, and seizes them in its slender paws. Besides insects, various fruits form part of the moholi's food, more especially such as are of a pulpy nature, and it is said that the moholi eats that vegetable exudation which is known by the name of gum senegal. Its diurnal repose is taken in the curious nest which it builds in the forked branches of trees, using grass, leaves, and other soft substances for the purpose. In this lofty cradle the young are nurtured until they are of an age to provide for themselves.

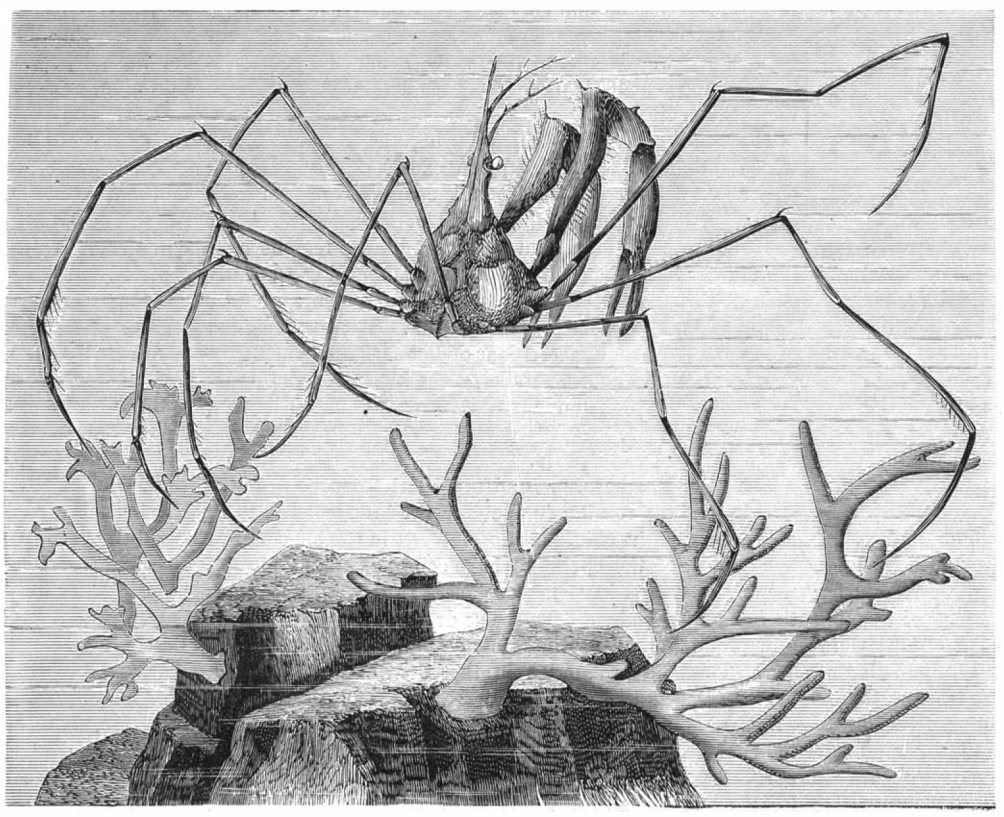
The face is full of expression, in which it is aided by the large and prominent ears; and the creature is said to contract its countenance into strange grimaces, after the fashion of the ordinary monkeys. Like the monkeys, too, it can leap for some little distance, and springs from one branch to another, or from tree to tree, with agility and precision. The moholi galago is an inhabitant of Southern Africa, having been found by Dr. Smith hopping about the branches of the trees that bordered the Limpopo river, in twenty-five degrees of south latitude.



MOHOLI.—*Galago Moholi*

SPIDER CRAB.

The body of this singular little crustacean is almost triangular, with a pointed protruding head. Notwithstanding its long slender legs it moves very slowly, never swimming, but crawling without touching its body to the ground. All kinds of sea tangle, plants, and sponges plant themselves on the backs of these crabs, sometimes completely enveloping them. These growths are so constant and so rapid that the creature can only free itself at the time when it changes its skin. This portable garden furnishes the crab with food which it gathers with its shear-like claws.



SPIDER CRAB.—*Stenorhynchus Longirostris.*

Hybrid Geese.

Mr. Charles Darwin communicates to the current number of *Nature* an interesting case, in which hybrid geese, the offspring of two distinct species, have proved quite fertile *inter se*. The common goose and the Chinese goose are so distinct that they have been placed in different genera or sub-genera; and yet they interbreed, and their offspring prove fertile. Mutual sterility is, therefore, shown to be no safe or immutable criterion of specific difference.

We have, however, says Mr. Darwin, much better evidence on this head, in the fact of two individuals of the same form of heterostyled plants (those in which the style varies in length in different flowers) which belong to the same species, yielding, when crossed, fewer seeds than the normal number, and the plants raised from such seeds being, in the case of *Lythrum salicaria*, as sterile as the most sterile hybrids.

Buried Oak Timber.

In deepening a river in the neighborhood of Norrköping, says the *Timber Trades Journal*, in order to make it accessible for ships of heavier draught, among several objects of interest brought up from the bottom, eight oak trees were found at a depth of seven feet under the old bottom. The bark was almost decayed, and when it was taken off the wood was found to be hard and black, resembling ebony. The trees are supposed to have been lying in the earth 900 years. The trees have been sold to a firm of joiners, who intend using them for cabinet work.

NATURAL HISTORY NOTES.

Insects Destroyed by Fungi.—Dr. Hagen, of Harvard University, in a paper on the destruction of obnoxious insects, after describing some experiments which had been made by Mr. J. H. Burns and others, draws the following conclusions: 1. That the common house fly is often killed by a fungus (*Sporendonema*), and that in epizootics a large number of insects are killed by the same vegetable parasite. 2. That the fungus of the house fly works as well as yeast for baking and brewing purposes. 3. That the application of yeast on insects produces in them a fungus which becomes fatal to insects. 4. That in the experiment made by Mr. Burns, all potato beetles sprinkled with diluted yeast died from the eighth to the twelfth day, and that the fungus was found in the vessels of the wings. He admits that further experiments are necessary to find out the most convenient method of application.

The Floating Fern.—One of the most widely disseminated tropical ferns is *Ceratopteris thalictroides*—a plant easily cultivated and propagated. Mr. Curtiss, in the *Botanical Gazette*, records the fact that he has collected fertile specimens of it in Florida. It appears to exist under widely different conditions, and it is very variable in size, and in the cutting of the fronds. Several of the forms have been described as species, and they are also cultivated under the generic name of *Parkeria*. Regarding the forms as belonging to one species, varying according to its habitat, it is generally dispersed in tropical and sub-tropical Asia, Africa, America, and Australia. Sometimes it grows in the muddy banks of rivers, in marshes, and other wet places, rooting in the ground. It is often found floating, however, like *Pistia* and *Azolla*. Mr. Curtiss found it floating free in water ten feet deep. Like some species of *Asplenium*, it propagates very freely from the buds which are abundantly produced on the fronds. Sometimes, as Wilson observed in Jamaica generally, the floating wild plants are much smaller than the cultivated ones, ranging less than six inches in height, including the fertile as well as the rosette of broad sterile fronds.

"Voice" in Fishes.—In a recent number of *Nature*, Mr. S. E. Pool gives an interesting account of an observation made by him in support of the claim that fishes are endowed with the faculty of voice. He stated that while engaged in a survey of the Disang River, in Eastern Asia, some six years ago, he had occasion to sound the depth of a pool. When seated in a small canoe and slowly nearing it, he suddenly became aware of the presence of a number of fishes called "mahsir." They were evidently attracted by the canoe, and Mr. Pool surmised that they might possibly think it a huge dead fish. While watching their movements he became aware of a peculiar "cluck" or percussive sound, which was frequently repeated on all sides, and coming from below, but near by. This was soon traced to the "mahsir," and one of them made distinct sounds which were answered by others. He states that in some parts of eastern Assam a large bivalve sings in concert with others.

The apparatus by means of which certain fishes are enabled to produce sounds has, according to the *Correspondance Scientifique*, been studied quite recently by a Danish naturalist, M. W. Sorensen. This gentleman, during his residence, in 1877 and 1878, at the point where the Riacho del Oro empties into the river Paraguay, discovered that the principal organ of sound was the swimming bladder. This, in the siluroids, is somewhat elastic throughout its whole length, while in the characins the elasticity depends especially on flat bands or round cords in its walls. The swimming bladder, as an organ, acquires its greatest development in the siluroids. In the species of the genera *Platystoma* and *Pseudaroides* it is divided by one longitudinal septum, and several transverse ones, into a few chambers or cells which communicate freely with each other. In the genus *Doras*, the swimming bladder has numerous appendages which are divided internally by incomplete septa, into a large number of small cells. In all these fishes the transverse apophyses of the first two or three vertebræ, and often a portion of the arch of the first vertebra, are not only joined together, but also with the posterior part of the cranium and the apophyses of the first vertebræ, by very strong elastic membranes. The transverse apophyses of the second and third vertebræ are in the form of very powerful springs, and are closely connected with the swimming bladder. The sound is produced by the action of muscles, which are inserted either directly on the swimming bladder or on the transverse apophysis of the third vertebra. In the characins, the elastic parts of the swimming bladder are stretched longitudinally by the contraction of the muscles, and the vibration which results from this rhythmical movement is transmitted to the air contained in the cavity of the bladder. In the siluroids, the anterior part of the bladder is drawn alternately backward and forward by the contraction and relaxation of the muscles; and during these movements the air, in passing through the incomplete transverse septa, sets the latter in vibration, and thus a sound is produced. The loudness of the sound emitted is in direct proportion to the velocity with which the springs vibrate. The fishes studied by M. Sorensen in connection with this subject belonged to the genera *Ageniosus*, *Doras*, *Platystoma*, *Prochilodus*, *Chalcinus*, and a few others.

An Open Winter and Spring Flowers.—At a meeting of the Torrey Botanical Club, on January 13, one of the members reported that he had found the liver leaf (*Hepatica triloba*) and the field chickweed (*Cerastium arvense*) in flower on the 11th of January of the present year, at Riverdale on the Hudson; and it was also stated by another member that the flower buds of the trailing arbutus gave evidence that

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they would soon open if the present warm weather continued.

The Sagacity of Penguins.—In the report of M. E. Mouchez on the Transit of Venus Expedition to the Island of Saint Paul, now being issued by the French Academy, the author, in speaking of the habits of the penguins, as observed on that island, gives the following instance of their sagacity. When these birds, which are extremely awkward and slow in their movements and incapable of flight, come to a perpendicular wall of rock, and can find no way of passing around it, they prepare to scale it in the following manner: The first arrived squat down close to the base of the rocks, then those which follow press up closer and closer, and, climbing over the backs of the former, make, in their turn, a gradual series of short steps, over which the remainder pass. Unfortunately M. Mouchez neglects to inform us how the birds which form the bottom rounds of the ladder manage to get over!

The Utility to Flowers of their Beauty.—Mr. Darwin, in his "Origin of Species," says that "flowers rank among the most beautiful productions of nature, and they have become, through natural selection, beautiful, or rather conspicuous, in contrast with the greenness of the leaves, that they might be easily observed and visited by insects, so that their fertilization might be favored. I have come to this conclusion from finding it an invariable rule that when a flower is fertilized by the wind it never has a gayly-colored corolla. Again, several plants habitually produce two kinds of flowers—one kind open and colored, so as to attract insects; the other closed and not colored, destitute of nectar, and never visited by insects. We may safely conclude that if insects had never existed on the face of the earth, the vegetation would never have been decked with beautiful flowers, but would have produced only such poor flowers as are now borne by our firs, oaks, nut, and ash trees, by the grasses, by spinach, docks, and nettles." With this for his text, the Hon. Justice Fry, in an interesting article in the December number of the *Contemporary Review*, proceeds to discuss the facts bearing on the case, both such as have been observed by himself and by others, and arrives at the following conclusions: 1. That conspicuousness is *a* step toward fertilization in one mode, and might therefore well be used by an artist loving at once beauty and fertility. 2. That there is no such preponderating advantage in beauty as should convert the ugly wind-fertilized flowers into the brilliant insect-fertilized flowers. 3. That in an infinite number of cases beauty exists, but without any relation to the mode of fertilization. 4. That it is maintained in many cases where the uglier and less beautiful plant is more useful, as in the case of the violet. 5. That even where conspicuousness is useful, it furnishes no complete account of the whole beauty of the flower.

As to the application of these facts to the two rival theories: if, on the one hand, nothing has become beautiful but through the utility of beauty, the latter will be found where it is useful and nowhere else. But investigations show that beauty is found where there is no utility; so the theory, in our present knowledge, is inadmissible. If, on the other hand, there be an artificer in Nature who loves at once utility and beauty, he may use the one sometimes as the mean to the other, or he may use beauty without utility; and the presence of beauty without utility is intelligible.

Peach Tree Borer Infesting Almonds.

During the past half dozen years the double white and pink almond shrubs growing in my garden have shown signs of being badly diseased. At first I thought little of it, as these shrubs are plentiful and multiply quite rapidly by suckers, but so many died outright that I was led to make a careful examination of their roots, and in these, and in the stems just below the surface, large numbers of the larva of the common peach tree borer (*Ægeria exitiosa*) were found. Peach trees being but little grown in my neighborhood the borers took to the almonds and here kept at work until few good plants are left.

Having quite a large number of the almonds, and seeing that the borers were well established, I concluded to leave them undisturbed in order to watch their progress during the summer, and ascertain if Harris was correct in saying that the moths appeared at all times from June until October. At various times during the summer I dug up almond plants, and invariably found grubs of all sizes, from those a few days old up to the nearly or quite full grown, but no pupæ were discovered under the bark or in the earth immediately surrounding the wood, a fact that leads me to believe that the grubs go a much greater distance from their burrows before passing into the pupa state than is generally supposed. Pupæ that are so frequently found in the gum exuding from peach trees are probably imprisoned there and cannot get away, else they would do so and find a more congenial place for passing through their final transformation. Harris states that the pupæ are found in the gum of peach trees; also under the bark and in the ground; but so far as my own observations extend I conclude that they will always seek the latter.

The old dwarf almond bushes in gardens are excellent breeding places for this insect, and it would be well for all who love such plants to examine them occasionally, and destroy all the grubs found. Peach trees may be protected with tar paper bands, but this is not practicable with such slender and free sucking plants as the dwarf flowering almond.—*A. S. F., American Entomologist.*

Saccharomyces Exiguus.

This variety of alcoholic ferment was identified by Rees, who met with it in the fermented juice of fruits. The cells are elongated and almost cylindrical in form, and are generally joined together so as to give a star-shaped appearance; their average length is 0·000118 inch, and their diameter only 0·000098; they are therefore much more minute than the ordinary yeast cells, and on this account are somewhat difficult to detect under the microscope; like all the other varieties of this species they multiply by budding and sporation. We are led to give these particulars of this form of ferment, says the *Brewers' Guardian*, in consequence of some recent researches of Muller and Hauer, which seem to prove that the deterioration of beer is largely due to the presence of this organism.

Some few years since Engel stated that the existence of *Saccharomyces exiguus* in beer ultimately produced a most unpleasant flavor, and these latest researches corroborate this view; we are now told that beer containing this ferment rapidly undergoes change; its brilliancy and pure flavor disappear, and soon becomes cloudy and acquires a greenish-gray tinge, and develops a most unpleasant taste and smell. It is, therefore, of the utmost importance that brewers should examine their seed yeast most carefully with a powerful microscope, in order that they may reject any samples which contain this most injurious ferment; its detection is not easy, on account of its extreme minuteness, but with practice the cells may be identified.

The Germs Floating in the Atmosphere.

An elaborate series of experiments has been undertaken by M. E. C. Hansen, at the Carlsberg Laboratory, with the object of identifying the various organisms which float about in the atmosphere, and which are found in worts and beer. These investigations form a valuable addition to those of Pasteur and Tyndall, who have already placed on record the results of their experiments in the same direction. It has been observed that the germs of yeast proper are very seldom met with in the atmosphere, but an infinite variety of moulds abound in almost all parts Pasteur found that besides moulds and bacteria, he occasionally met with the following organisms: *Mucor racemosus, Saccharomyces mycoderma, S. pastorianus, S. ellipsoideus, S. apiculatus, S. cerevisiæ*, and bacteria, producing butyric and lactic acids.

M. Hansen found in his experiments that saccharomyces are very seldom met with in the atmosphere; bacteria are usually present, but they are not nearly so plentiful as the various kinds of moulds, among which *Penicillium glaucum* is the most common. In very cold weather it was noticed that all varieties of saccharomyces disappeared, but even then moulds and certain forms of micro-bacteria were to be met with.

One Year's Production of Petroleum.

The petroleum business during the year just closed has been marked by many results never before attained. The enormous production of crude (nearly 20,000,000 barrels) exceeded the production of any previous year by about 5,000,000 barrels. The average price of crude at the wells for the year was 94⅜ cents per barrel, being 39⅝ cents less than for the year 1874, which has been heretofore considered the "cheap oil year."

The number of wells drilled during the year was 3,038, which number was not greatly in excess of former years; only about 6¼ per cent of the wells completed proved to be dry or worthless, against 11⅛ per cent of dry holes developed in 1878. The shipments out of the producing regions have been larger than in any previous year, amounting to nearly 16,000,000 barrels, which exceeded the shipments of 1878 nearly two and a quarter million barrels. The accumulation of stock in the producing regions of Pennsylvania during the year has been without a parallel in the history of the trade; the amount of stock January 1, 1879, was 4,615,299 barrels, and on January 1, 1880, 8,470,490 barrels, being an increase of 3,855,191 barrels in 1879.

The great Northern, or Bradford district, has contributed largely to these results; in fact for the last two years this field has been the chief point of interest in the oil country, where most of the operators have congregated and most of the developments have taken place. In the last five years there have been about 6,000 wells drilled, 5,100 of which are now producing oil at the rate of about 45,000 barrels per day. The total production in that district from August, 1875, to December 31, 1879, was 21,991,544 barrels, and the shipments out were 15,771,214 barrels, leaving a stock in tanks of about six and a quarter million of barrels. The exports of petroleum for the year have been unprecedentedly large, exceeding all former years by many million gallons. The stocks held in European ports are also quite large, exceeding the amount held at the same time in 1878 some 500,000 barrels.

The maximum production of crude petroleum in the Pennsylvania oil fields was reached in August, 1879. Since that time the production has undoubtedly been steadily on the decline, and from present indications we may look for a continued decline, slowly but surely, until some new and now unknown field shall be found which shall yield the precious fluid bountifully.

There was a steady increase of stock at the wells during the first eight months of the year, which was not reported and did not go into the account in making up productions and stocks. The pipe lines prior to September did not take from the wells their production, which was evident from the overflowing tanks everywhere to be seen in the Bradford district. Since the month of August the wells have not only been relieved, but the lines have been taking all the production and steadily drawing on well stock. The month of December shows that the stock at the wells has been depleted about 182,250 barrels, which we have credited to productions and stock by distributing 750 barrels a day through the first eight months of the year.—*Stowell's Reporter.*

Fluid for Preserving Organic Substances.

M. Wickersheimer, of the University of Berlin, has invented a fluid for the preparation of animal and vegetable tissues, which surpasses anything before known in its power of preserving the color, form, and elasticity of specimens treated with it.

The fluid may be injected into the veins of the body to be preserved by it, or the entire object may be immersed in it. In either case the elasticity of the tissues and the flexibility of the joints are preserved.

At a recent meeting of the Philadelphia Academy of Natural Sciences, Professor Barbeck described a number of skeletons, which showed beautifully the combined movements of the chest, larynx, and other parts engaged in the mechanism of breathing. Several skeletons of snakes, which had been treated with the fluid more than a year previously, permitted of undulatory and spiral movements. Lungs thus prepared may, even after years, be inflated by means of bellows. Such old lungs were seen to swell to ten times their size in the collapsed state, the lobes became distinct, the brown color gradually changed into red, and the whole organ appeared as if taken from a fresh body. Sections of delicate tissues, morbid formations which have been removed by an operation, will appear after months as if in a fresh state, and may thus be preserved for future study.

All sorts of vegetable organisms may also be preserved in this fluid. A colony of exquisite fresh water algæ, which had been in the fluid for a year, appeared to be growing in the water.

The Prussian Government has purchased this valuable discovery, and the Minister of Instruction has published it in his official organ for the benefit of the scientific world. The formula for the preparation of the fluid is as follows: In 3,000 grammes of boiling water dissolve alum, 100 grammes; common salt, 25 grammes; saltpeter, 12 grammes; carbonate of potash, 60 grammes; arsenious acid, 10 grammes. After cooling and filtering, add to every ten liters of the solution four liters of glycerine and one liter of methylic alcohol.

The method of application differs according to the nature of the objects to be preserved. Anatomical preparations that are to be preserved dry are immersed in the fluid from six to twelve days, according to their size, then taken out and dried in the open air. Hollow organs, such as the lungs, etc., must be filled with the preserving fluid, then laid in a vessel containing the same liquid, and afterward distended with air and dried. Smaller animals, such as crabs, beetles, lizards, frogs, etc., if the natural colors are to be preserved unchanged, are not to be dried, but put immediately into the preparation. The same fluid may be used for the purpose of preserving human bodies during transportation, or even for more permanent embalming.

Milk a Forbidden Food in China.

The Chinese, who esteem rats to be a delicacy, are down on the use of milk. The following translation of a Chinese placard regarding the highly immoral practice of consuming cow's milk is sent to the *Foochow Herald* for publication: "Strictly refrain from eating cow's milk! Man should not rob the beasts of their food. Moreover of all beasts the cow is the most useful and meritorious. Men who do not discriminate between mankind and beasts are worse than senseless. Those who sell milk darken their consciences for gain, and those who eat cow's milk foolishly think they are benefiting their bodies. Men who take medicine should first carefully investigate and find out its nature. Why do not those who eat cow's milk consider and inquire into its origin? For instance, men beget children, and while the children are small they depend upon milk for their nourishment; so it is also with beasts. But when men buy milk to eat, do they not do injury to the life of the calf? And is there not bitter hatred and distress in the minds of both cow and calf? Beasts cannot speak; how then are they able to tell the man that, in eating the milk of beasts, his body becomes like that of birds and beasts? But if men wish to take strengthening medicine, there are numberless other articles in the world that are beneficial; and what necessity then is there for taking cow's milk? Besides this, the death and life of men have their fixed number and limit, and this cow's milk cannot lengthen out and continue the life of man. Since, then, all know the truth—that it cannot do this, all ought to act with loving and benevolent spirit. Especially all who receive this exhortation should keep from eating milk. The children of those who cause their families to refrain from eating milk will be preserved to grow up; they also will thus lengthen out their own lives, and will escape from evil in time of fatal epidemics. If such persons be able also to exhort others, who are ignorant of first principles, to leave off the eating of milk, their descendants shall surely prosper. Published by the Hall of Good Exhortations. The Xylographic blocks are deposited in the Ung Ling Kóh."

It is said that the adhesiveness and durability of a solution of 100 parts gum arabic in 250 parts water may be increased by adding 2 parts of sulphate of alumina.

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ANCIENT EGYPTIAN GLASSWARE.

On the tomb of Beni Hassan there are paintings representing Theban glass blowers working with blowpipes like those used at the present day. These paintings are supposed to date from the reign of Osortasen I., about 3000 B. C. At Thebes a necklace of glass beads was found bearing the name of the Queen of Thothmes III., who reigned about 1500 B. C. The Egyptians were skillful in the manipulation of glass, as many specimens preserved in the British Museum attest. Our engraving shows several specimens of this ancient ware; some of it is made of party-colored glass, while other specimens are plain.

EGYPTIAN GLASSWARE (1500 B. C.)

Why the Sky appears Blue.

"Why is the sky blue?" is a question, says a recent number of the *Academy*, which has often been asked, but never satisfactorily answered. Helmholtz offered an explanations which depended on the reflection of solar light by the air particles in the atmosphere. These particles being very minute would reflect preferably the shortest waves of light, namely blue waves, while they would allow the longer waves, corresponding to green and red light, to pass through them; just as a log of wood floating on the surface of still water would throw off the tiny wavelets caused by a falling drop in its neighborhood, while the same log in long ocean swells would be tossed to and fro without noticeably impeding the progress of the waves.

Dr. E. L. Nichols (in the *Philosophical Magazine* for December) has propounded another view, which has much to recommend it. According to Young and Helmholtz's theory of color-impression there are in the eye three sets of nerve-termini, one set chiefly influenced by the red, another by the green, the third by the violet rays. The impression of color is the resultant of the intensities of these three effects. The impression upon these nerves is not directly proportional to the intensity of the ray, the different nerve-termini being subject to different laws. For very feeble rays the "violet" nerves are very sensitive, while the "green" and "red" nerves scarcely act at all. As the light increases in intensity the "red" and "green" nerves increase in activity, while the "violet" nerves become tired and dazzled. For rays of dazzling brilliancy the "red" nerves are in their most sensitive condition. Thus, of the simple colors, as the brightness increases, red and green change to yellow, blue becomes white. Daylight at ordinary intensities affects the three sets of nerve-termini equally; the resultant impression is whiteness. Now daylight is simply the light of the sun weakened by manifold diffuse reflections. The direct rays of the sun, as we let them fall upon any colorless object, appear also a white light; but on attempting at noon on a clear day to gaze into the sun's face the impression is of blinding yellow. It is not that the direct rays differ in composition from diffuse daylight, but that the "violet" nerves cannot transmit the action of such strong light. The moon, with enormously less illuminating power than the sun, seems bright, and is far brighter than the open sky. In passing from the intensity of the moon's rays to those reaching us from a corresponding bit of the open sky, we may, perhaps, take a step as great as that between the brightness of the sun and moon. In general, white light will appear bluer and bluer as its intensity diminishes, and this law will apply to the skies; as the light they reflect becomes fainter and fainter they will increase in blueness, even though the light by the process of reflection suffer no change in composition.

An Examination at the Institution for Deaf Mutes at Passy.

M. Houdin, the director of the institution, explained the method he has been putting in practice for thirty years, and which has for its object to teach mutes to speak and to instruct them by speech. He further stated that the constant testimony of facts, as well as the scientific data, show that all intelligent deaf mutes endowed with vision, the sense of touch, and an intact vocal organ, can speak, read speech on the lips of others, and can be taught by speech, and thus enter into communication with society. And he also remarked the superior position of the deaf mute who has been taught speech, to that of the mute who can only make signs which nobody understands.

A child, six years old, was presented for examination. He read fluently, with a clear voice, words which were written for him on the blackboard. He also named equally well all objects pointed out to him. He could also read from the lips all the words spoken to him, and wrote them on the board with a skill and rapidity quite extraordinary for a child of his age. He is able thus to read, articulate, and write all the words of the French language. He now uses, in ordinary phraseology, about 600 words, and, without doubt, will master the language and complete his education by this method of instruction.

Then followed an exhibition of pupils of three to four years of age, who read from the lips of others, spoke, and wrote from oral dictation. Madame Houdin dictated to them from a book, and they reproduced the text accurately without the least fault of orthography; and then they read aloud what they had written. Two of the pupils, young ladies, passed through the audience and answered intelligently and gracefully the questions put to them.

It was also noticed that in these children the expression of face was lively and happy, which is quite different from what is usually seen in the deaf who remain dumb. Their speech seemed natural, warm, expressive, and live, and not at all mechanical, cold, monotonous, and dead, as is often found in deaf mutes who have learned to talk.

M. Houdin explained that this success was due not only to particular care as to the manner of speaking in private and family life, but also to the precaution taken to make not only one organ speak after being put into mere automatic motion, but to make the intelligence speak through that organ, which alone can give warmth, color, and life to speech.

There was then presented a young man, 16 years old, who had become totally deaf at 11 years of age, and who would have ended by losing his speech had his education been continued by signs, but in whom, on the contrary, speech had continued to improve even after considerable cessation of use, which had altered it greatly, and whose education finally could be completed by lip reading simply. His own statement was: "All I know is, that M. Houdin has taught me to read from the lips, and that I *see* the words instead of *hearing* them."—*La France Médicale.*

Court Plaster.

Soak isinglass in a little warm water for seventy-four hours; then evaporate nearly all the water by gentle heat; dissolve the residue in a little dilute alcohol, and strain the whole through a piece of open linen. The strained mass should be a stiff jelly when cold. Now stretch a piece of silk or sarsenet on a wooden frame, and fix it tight with tacks or pack thread. Melt the jelly, and apply it to the silk thinly and evenly with a badger hair brush. A second coating must be applied when the first has dried. When both are dry, apply over the whole surface two or three coatings of balsam of Peru. Plaster thus made is very pliable, and never breaks.

Petroleum in Colorado.

The Pueblo *Chieftain* says: A visit to the works of the Pioneer Oil Company, in South Pueblo, disclosed the fact that the company has its drill down something over 760 feet. The superintendent says that the drill is now over 1,200 feet below the coat measures, and every indication was as the most sanguine of the company expected. He thinks they will have to go 1,300 feet, or perhaps more, before they strike a flowing supply. The company has ample capital, and will go 2,000 feet, if necessary, to strike it. The formation gone through so far is almost identical with the formation of the Pennsylvania oil regions.

Introduction to a Biographical Sketch.

In the last issue of the *Journal of Science*, published in London, is a lengthy and interesting paper on the life and character of Hon. Henry Cavendish, F.R.S., an eccentric genius who lived in London from 1731 to 1810. Mr. Cavendish spent his life of eighty years in scientific investigations, leaving a record of his electric researches which were more complete than had been made by others at the time of his death. The writer, before introducing the subject of his biography, pertinently alludes to the advantages scientists of the present day have over those of the last century from the facility now had for promulgating discoveries and exchanging ideas through the public press.

If there is one Scriptural admonition, says the biographer, which the scientific workers of the present day fail to obey more rarely than another, it is the one which warns us against the foolishness of hiding our light under a bushel, instead of setting it on a hill so that it may shine before all men.

Every discoverer, nowadays, whether great or small, as soon as he finds his light—whether it be a six-thousand-candle electric lamp or only a halfpenny dip—immediately hastens to place it on the top of the tallest hill he can find, so that it may shine forth literally *urbi et orbi*. Many lights, it is true, give forth only a feeble glimmer; but it is surely better that we should be at times overburdened with crude observations of possibly valueless facts, than that a single particle of truth should be concealed, or its publication delayed even for a day more than is absolutely necessary.

There never was a period in the world's history when scientific observation was so universal as in the present year of grace, and it never before had such a chance of being so thoroughly controlled by publication and criticism. An important discovery in any branch of physical science is now made public with a rapidity that has never before been equaled, and the paper, article, or even telegram containing its history is published and republished, discussed, and criticised in every civilized language. The observations described are repeated and tested in half a hundred laboratories, and the slightest incorrectness or misstatement is pounced upon with the utmost eagerness, and published with the same universality as the original researches themselves. The numerous facilities which we possess for spreading and sifting scientific observations are bearing fruit every day, and the scientific press—although its office is to collect and distribute facts rather than to criticise them—has become as great a power in its own particular sphere as its elder sister, the political press, has in the hands of our political fellow workers.

A Wonderful Surgical Operation.

The *Evening Post*, one of the most reliable of our city dailies, gives the following account of a very remarkable operation now proceeding at Bellevue Hospital. The patient is a young man, twenty-one years old, who lost his nose through what is known as a lupoid ulcer, the result of a blow from a club, and the operation will result in the replacement of that useful organ, or rather the substitution of a part of one of the sufferer's fingers for the missing feature. The first step, which was taken some weeks ago, was to remove the nail from the middle finger of the patient's left hand. Two deep incisions were then made at the base of the nose, and pieces of flesh were brought down to cover the opening caused by the destruction of the nasal bones and cartilages. Next incisions were made at the upper extremity of the nose to form a pocket for the reception of the end of the finger to be transplanted. The next step was to open the finger from the second joint to the tip and to place the finger in position on the patient's face, securing the flaps by silver sutures. This was done five weeks ago, and the surfaces have united admirably. The next operation will be the amputation of the finger at the first joint, when the bones of the transplanted phalanges will serve admirably to replace the nasal bones. A triangular flap of skin will then be brought down from the forehead to form a uniform surface for the new nose, and the job will be completed. It may be added that at one point of the operation the patient's breathing was so obstructed by blood running down his throat that it became necessary to insert a silver tube in his windpipe.

During the last few weeks the patient has been kept under the influence of anæsthetics, and his arm and head have been kept in position by means of plaster of Paris. The operation was suggested by a similar experiment in Birmingham, England; but it is so much more complicated in its nature that it is practically original.

REMEDY FOR CORNS.—Mr. Gezow, a Russian apothecary, recommends the following as a "sure" remedy for corns, stating that it proves effective within a short time, and without causing any pain: Salicylic acid, 30 parts; extract of cannabis indica, 5 parts; collodion, 240 parts. To be applied by means of a camel's hair pencil.—*Pharm. Zeit.*

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Railroad Construction in 1879.

The total of the year was 4,430 miles, which is the largest since 1872, and has been exceeded only four times in the history of the country—the four years ending with 1872. For the eight years that we have made up this record, which includes road on which *track was laid* during the year, whether opened for traffic or not, and differs materially from the figures in *Poor's Manual* (which usually include only road open for business), the miles of new road constructed have been:

Year.	Miles.	Year.	Miles.
1872	7,340	1876	2,460
1873	3,883	1877	2,301
1874	2,025	1878	2,916
1875	1,561	1879	4,430

Compared with 1878, therefore, last year shows an increase of more than 50 per cent. At the close of 1878, according to *Poor's Manual*, the length of railroad in the country was 81,841 miles. Adding the mileage constructed in 1879, we have the grand total of 86,263 miles of railroad in the United States at the beginning of the current year, when the total of all Europe is about 100,000 miles, and of all the rest of the world probably not 20,000 miles. The increase in this country was at the rate of about 5½ per cent, the increase of population being doubtless something less than 3 per cent so that the number of inhabitants per mile of railroad has become less during the year. The population of the country is now probably about 49,500,000, and this gives 574 persons to support 1 mile of railroad, against 585 at the beginning of 1879. In Europe the average is about 3,333 per mile of road, and in Sweden, where the mileage in proportion to population is largest, it is 1,667. We have given these figures before, but we repeat them to emphasize the fact that this is peculiarly the railroad country, not simply because it is big, but because the same population requires a larger amount of railroad here than anywhere else.

Of the 4,430 miles, 923½ miles are of narrow gauge (18 miles 2 feet, 23 miles 3½ feet, and the rest 3 feet gauge). This is a little less than 21 per cent of the whole, against about 30 per cent in 1878.—*Railroad Gazette.*

Recent Explorations in Afghanistan.

For a period of about 40 years it has been known that interesting Buddhist remains existed in the Jellalabad Valley, although little or no attention has been given to their investigation. Mr. William Simpson, having been quartered for some months in the valley, with the force under General Sir Samuel Browne, has been able to visit most of the remains in that region and to make sketches of them, and the results of his investigations are given by him in a paper published in a recent number of the *Journal of the Society of Arts.* These Buddhist remains, says Mr. Simpson, are little more than mounds. Here and there the crumbling remains of a stupa may be seen, and fragments of walls can be traced in the heaps. The immense quantity of these mounds is astonishing; and, as it is known that these Buddhist establishments were monasteries, the extent of the remains seems to indicate in the past a population of ascetics alone far greater than the population of the present day. In the Buddhist period, the country must have been under a high state of civilization, where wealth abounded and art was cultivated. The vestiges of art still remaining show that the religious structures of the time were large and important. A style of architecture was followed in which sculpture was largely practiced, and in which the effect was heightened by the use of color and gold. The structures connected with the practice of the Buddhist faith were "viharas," or monasteries, places in which each monk had his cell, and with buildings for worship. One prominent form of the ritual was connected with structures which are now known as "topes" or stupas. "Dagoba" and "chaitya" are also terms used to designate the same kind of structure.

The Afghanistan tope, unlike those of Sanchi, Bharut, and Amaravati, have a square base. It is ornamented with a cornice and pilaster; large and imposing stairs are made to ascend to the platform formed by it above, on which the circular part of the tope stood. Among the topes in the Jellalabad Valley which are not quite reduced to the condition of mounds, the Greek influence is very distinctly marked in the architecture. The capitals are all Corinthian; and the more ornamental structures have a series of Corinthian pilasters, with base mouldings and friezes.

Regarding the monasteries little can be said, for scarce a vestige of them now remains. All throughout Afghanistan there is an immense number of caves. At Bamian, about a hundred miles north of Cabul, there is what may be called a city of caverns. At Hada, and at almost all the groups of topes, there are numerous caves associated with them. Nearly all of these, as a rule, are about the same size. They are merely arched recesses in the rock, about 12 feet high, of the same width, and about 20 feet long. That they were decorated with color is shown by the traces still visible in the decorations in a small group at Hada. Enough is left also to distinguish panels, in rows, with heads of Buddha or Buddhist saints with the nimbus. At Darunta there is a very large and remarkable group of caves. The rock above had monasteries and topes of an extensive character upon it. The most interesting of these caves are in a perpendicular cliff overhanging the Cabul river.

Mr. Simpson concludes his paper with a short account of the excavations made by him at the Anin Posh tope, near Jellalabad. Of this structure nothing is left but the lower part of the square base; and there is only a small portion remaining of the first course of masonry of the circular part of the tope, and which is 80 feet in diameter. The base is 100 feet square, and is ornamented with Corinthian pilasters. There had been an inclosure all round the tope, forming a courtyard about 500 feet square. Through this the principal gateway entered from the south, in a line with the original stairs on the south and north side of the tope. This approach was evidently an important construction. There was further evidence of what it had been in the remains of colossal figures, which were brought to light. The size of these may be judged of by the size of the feet, which were 23 inches long, and which were all that remained of the statue to which they belonged. On digging a tunnel into the center of the tope, the external wall was found to be composed of stones and slates, so arranged as to produce a diaper or checkered pattern—a style of masonry peculiar to all the remains of the Buddhist period. In his excavations, Mr. Simpson was fortunate enough to come upon the cell, which was formed of layers of slate, and was a perfect cube of 16 inches. In this small repository, which constituted the sanctum, in honor of which the monument had been raised, and to which the ritualistic ceremonies of the Buddhists were directed, there were found two handfuls of dark looking dust, which were probably part of the ashes of some noted holy man of the time, deposited after cremation—the rule of the Buddhist priesthood. On top of the ashes lay a golden relic holder, octagonal in form, about 4 inches long, and set on each of its faces with stones. Among the ashes were 20 gold coins, 17 of them Bactrian or Indo-Scythian and 3 Roman. These coins, which were in splendid condition, and the relic holder, were no doubt deposited as offerings along with the ashes at the consecration ceremony of the shrine. The coins are only a negative evidence toward the date of the tope; but from them it is certain that the latter is not older than the second century. How much later it may be is rather a difficult question as yet to determine. The Roman coins seem to show that Afghanistan was the way of commerce from Central Asia into India in remote times.

The Viscosimeter.

This is the name given to an instrument by means of which the viscosity of a sample of beer can be determined. It consists in its simplest form of a funnel-shaped vessel, the lower extremity of which is drawn out to a fine point, so that the internal diameter is as fine as a capillary tube. A certain quantity of distilled water being placed in the funnel-shaped reservoir, a determination is made of the quantity which will run through in a given time, say five minutes; for example, we will assume this to be 21 cubic centimeters; the same quantity of the beer to be tested is then placed in the instrument, and an observation made of the quantity running through in the same time, we will suppose this to have been 15 cubic centimeters. The viscosity is in inverse proportion to the quantity of fluid flowing through the tube in a given time; taking the viscosity of water at 1,000, we have the following proportion:

$$15 : 21 :: 1000 : V.$$
$$\therefore \quad V = 1400.$$

Many precautions have, of course, to be taken; all determinations must be made at the same temperature, and, if possible, at the same barometric pressure; any excess of carbonic acid gas should be previously removed from the beer, by shaking a portion of it in a bottle until no more gas is given off; if the beer is at all thick it must be filtered, otherwise some of the suspended particles may mechanically close up the capillary tube. The determination of the viscosity of beer is of value for many purposes, for any great excess is an unfavorable sign. Any tendency toward "ropiness" can be detected by this instrument. It would also probably be of considerable value to the practical brewer for testing his worts, with the view of determining the dextrine ratio. A dextrinous wort will run through much slower than a saccharine wort, and we think some very useful results might be obtained by the aid of this instrument. Its construction is very simple, and any one with but a slight experience in chemical manipulation may make one for himself.

Speaking Dictionary.

M. Lambrigot has invented a modification of Edison's phonographic matrices, by substituting stearine for the tin foil, and electrotyping the impressed surface. It has been suggested that these electrotypes, which can be made very cheaply, may render great service in the study of foreign languages, for they preserve indefinitely and repeat as often as may be desired words that are the most difficult to pronounce correctly. A true speaking dictionary might thus be made, an undertaking which the wildest fancy would not have dreamed of a few years ago.—*Nature.*

The Brussels Exhibition.

In a letter to the Secretary of State, Mr. Goodloe, Minister at Brussels, calls attention to the Industrial, Agricultural, and Horticultural Exhibition to be held in Brussels this year, from June 15 to October 15. No foreign exhibitors will be invited or allowed to participate, but there will be an excellent opportunity for foreigners to critically inspect Belgian products, and it is suggested that enterprising Americans who have some of their wares on hand can show them to a great assembly gathered from every section of Europe. They will not be allowed to show goods in the Exhibition Building, for the Exhibition will be strictly a national one—a feature of the celebration of the fiftieth anniversary of the existence of Belgium as an independent nation.

AGRICULTURAL INVENTIONS.

Mr. Benjamin Middleton, of Muscatine, Iowa, has patented a device for heating hot-beds, green-houses, and the like. It consists in means for forcing heat and moisture to plants through an unvarying surface of porous bricks, tiles, or other equivalent substances.

Mr. Alexander B. Campbell, of Albion, Wis., has patented an improved harrow coupling, which forms a flexible connection between the several harrow bars. It consists in a harrow coupling formed of a clevis attached to a harrow bar, the upper shank of which clevis is lengthened and terminates in an eye, into which a bar hook attached to the forward part of the clevis of the following harrow bar passes.

Mr. William Pendley, of Ludville, Ga., has patented an improved machine for planting seed, distributing guano, cultivating cotton and other plants, and for other plowing. It is so constructed that it may be readily adjusted for these various uses.

The Crops of 1879.

The Agricultural Department has published a comparative table on the crops produced in 1878 and 1879, together with the prices obtained by the producers, as follows:

HARVEST.	1878.	1879.
Wheat, bushels	420,122,400	448,755,000
Corn, bushels	1,388,218,750	1,544,899,000
Oats, bushels	413,578,560	364,253,600
Rye, bushels	25,842,790	23,640,500
Barley, bushels	42,245,630	40,184,200
Buckwheat, bushels	12,246,820	13,145,650
Cotton, bales	5,216,603	5,020,387
Tobacco, pounds	392,546,700	384,059,659
Hay, tons	39,608,296	35,648,000
Potatoes, bushels	124,126,650	181,360,000
PRICE.		
Wheat	$326,346,424	$499,108,000
Corn	441,153,435	580,250,000
Oats	101,945,830	120,855,000
Rye	13,592,826	15,505,000
Barley	24,483,315	23,625,300
Buckwheat	6,454,120	7,860,488
Cotton	193,854,611	231,000,000
Tobacco	22,137,427	21,454,591
Hay	285,543,752	325,851,280
Potatoes	73,059,125	78,971,000
Total	$1,488,570,866	$1,904,480,659

This increase of some $415,000,000 in a single year is a most encouraging result. But there has also been a gain in other values besides those of the crops noted above. The statistician of the department, who is reported to be gathering material upon which to base a careful estimate of the total increase in certain other values during the year just closed, to include the increased price of real estate and mining property, expresses the opinion, based upon material already gathered, that it will not fall below $1,000,000,000.

Progress of Long Range Telephoning.

An important experiment with the telephone was made, January 25, between the Union Pacific Transfer on the east side of the Missouri River and the American Union office at St. Louis, a distance of 410 miles. The experiment previously made between Omaha and St. Louis had been unsatisfactory. Superintendent Dickey, of the telegraph lines, and also head of the Bell telephone system in the West; Manager Korty, of the Union Pacific Telegraph office, and Manager France, of the Omaha Telephone Exchange, conducted the experiment at this end of the wire, and Mr. Benedict, of the American Union, and Mr. Durant, of the St. Louis Telephone Exchange, conducted the experiment for St. Louis. Two jars, Callaud battery, were used at the Omaha end and five jars in St. Louis. But two or three interruptions of a few seconds each occurred, and these were clearly due to the "swinging" of the wires in the strong wind which was blowing.

An ordinary conversation was carried on with the utmost ease, the most noticeable fact being that, while the enunciation of the words was perfectly clear, they came invariably with the regular vibration of a musical note. The wires over the greater part of the distance were quiet and not in use, but at the St. Louis end there was a heavy induction.

Mr. W. H. Preece, in a recent lecture in London on sound, speaking of long distance talking by aid of the telephone, said that Prof. Bell and himself had carried on conversation through an instrument having a resistance that represented 10,000 miles of wire; in fact it was really a telegraph 10,000 miles long. He said there was no doubt whatever that if, like Jules Verne's hero, we could go to the moon and string a wire along that distance, there would not be the slightest difficulty in maintaining telephonic communication with the earth.

Aluminum Telegraph Wires.

German telegraphic engineers have lately been experimenting with aluminum as a material for telegraph wires. This metal can easily be drawn out to a very much finer gauge than is possible with iron, and its conductibility is twice as great as that of iron wire. Its excessive cost has hitherto prevented its use for the purpose indicated, but it is found that an alloy of aluminum and iron can easily be made, which will produce a wire both finer and stronger, and less susceptible to atmospheric changes than iron wire, while it is much superior as a conducting medium.

ATTENTION is called to the advertisement in another column of valuable manufacturing sites for sale and to let by the Dundee Water Power and Land Company, of Passaic, N. J. The water power is said to be ample and permanent. The place is at the head of navigation on the Passaic river; this, together with its proximity to Paterson, Newark, and New York city, renders it particularly desirable.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

Chase's Pipe Cutting & Threading Machine. Send for circular. Chase Machine Co., 120 Front St., New York.

Best Turkey Emery in bbls., kegs, and cases. Special rates for large quantities. Greene, Tweed & Co., N. Y.

J. F. Tallant, Engineer, Burlington, Iowa, makes a specialty of saving fuel and increasing power of defective boilers and engines.

The steam pipes, boilers, etc., of Messrs. Dunham, Buckley & Co., A. T. Stewart & Co., and S. Shethar & Co., are protected with H. W. Johns' Asbestos Boiler Coverings. H. W. Johns Manufacturing Company, No. 87 Maiden Lane, New York, sole manufacturers of genuine Asbestos Liquid Paints, Roofing, etc.

Blake's Belt Studs. The most durable fastening for rubber and leather belts. Greene, Tweed & Co., N. Y.

Ice Machines selected. Information on all kinds. Benjamin's Sci. Expert Office, 37 Park Row, New York.

Hydraulic Jacks and Presses. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

The best article (because it is common sense) we have read on the subject of high and advancing prices, appears in the editorial department of *Baldwin's Monthly*, just published for February. We say to every one of our readers, get a copy and read it. Baldwin the Clothier is the sole editor.

For Sale at a great sacrifice if sold soon. Half interest in Machine and Repair Shop. Inquire of "Machinist," Box 92, Farmington, Iowa.

Wanted—A Drill Press, a Bolt Forging and Heading Machine, and a Pulley Lathe, of some new and improved pattern. Good second-hand machines might answer. Address Columbus Iron Works Company, Columbus, Ga.

Wanted.—English Iron Farm Gates. Howard, Pikesville, Md.

M'f'rs of Physical, Optical, and Electrical Apparatus, also makers of small machinery and tools, send catalogues and price lists to G. M. H., Box 773, N. Y. city.

A Rare Chance.—We have on hand a 40 H. P. Horizontal Oscillating Engine, built for special work, but never used. It is first-class in all respects; has patent guides to prevent wear; has balance wheel, but no pulley. Price $350. Heald, Sisco & Co., Baldwinsville, N. Y.

New Inventions examined and tested. Designs and improvements. Reports for investors. Recipes and information on all industrial processes. Benjamin's Sci. Expert Office, 37 Park Row, New York.

For Sale.—One Wood Turning Lathe, 20″ swing, 14 ft. bed. Jig Saw and Face Lathe, for pattern work; also Blacksmiths' Tools. D. Frisbie & Co., New Haven, Conn.

Campbell's Self-acting Window Shade Rollers are the best in the market. Models and terms to the trade. 85 Centre St., New York.

Wanted--A Machinist of experience, competent to superintend a large manufactory. Address, with references, in full, F. Case, Box 387, Cincinnati, O.

Small High Speed Steam Yachts complete or in parts. Geo. F. Shedd, Waltham, Mass.

Forsaith & Co, Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Partner Wanted.—See advertisement on inside page.

Models made to order. H. B. Morris, Ithaca, N. Y.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 61.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., etc., sent post free on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 77.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 61.

For Machine Knives and Parallel Vises, see advertisement, p. 61. Taylor, Stiles & Co., Riegelsville, N. J.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Forges, for Hand or Power, for all kinds of work. Address Keystone Portable Forge Co., Phila., Pa.

Latest improved methods for working hard or soft metals, grinding long knives, tools, etc. Portable Chuck Jaws and Diamond Tools. Address American Twist Drill Co., Woonsocket, R. I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., New York.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eclipse Portable Engine. See illustrated adv., p. 94.

Repairs to Corliss Engines a specialty. L. B. Flanders Machine Works, Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 62.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Eagle Anvils, 9 cents per pound. Fully warranted.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

$275 Horizontal Engine, 20 H. P. See page 390.

Emery Wheels of all kinds, and Machines at reduced prices. Lehigh Valley Emery Wheel Co., Weissport, Pa.

Pat. Steam Hoisting Mach'y. See illus. adv., p. 93.

Improved Steel Castings: stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 93.

The Twiss Automatic Cut-off; also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN CHEMICAL JOURNAL.

The fifth number contains articles on the following subjects: On the Synthesis of Helicin and Phenol-Glucoside, by Arthur Michael; On a New Formation of Stilbene and some of its Derivatives, by Arthur Michael; On a New Method for the Separation and Subsequent Treatment of Precipitates in Chemical Analysis, by F. A. Gooch; On several Spanish Minerals, by F. A. Genth, Jr.; A Method for Estimating Bismuth Volumetrically, by M. Kuhara; New Results in Electrolysis, by Edgar F. Smith; Nitrosulphobenzoic Acids and some Derivatives, by Edward Hart. Professor Mallet continues his Brief Review of the most important Changes in the Industrial Applications of Chemistry within the last few Years, and a Report on Progress in Analytical Chemistry is continued by H. N. Morse, A variety of useful notes complete the number.

EXPERIMENTS ON THE STRENGTH OF WROUGHT IRON AND OF CHAIN CABLES. By Commander L. A. Beardslee, U. S. N. Revised and abridged by William Kent, M.E. New York: John Wiley & Son. 8vo. pp. 119.

An abridgment of Commander Beardslee's voluminous and valuable report published by the United States Government last year.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) T. asks: How many cells of Callaud battery will be required to do light silver plating? A. If you use a striking bath you will need eight or ten cells. Brass, copper, and German silver articles may be silvered with a single cell.

(2) C. E. H. asks: 1. Do you know of anything that may be added to the gelatine and glycerine, that forms the copying pad described in the SCIENTIFIC AMERICAN, that will make it more tenacious and not injure its copying properties, as with the ingredients given parts of the pad sometimes adhere to the paper used in copying? A. Heat the composition for several hours over a water bath to expel as much of the water (used in softening the glue) as possible. Then let stand several hours in a cool place to harden. If required to be used in a hot room, add more glue and, say 5 per cent, of alum to the composition. 2. Are there other preparations used for this purpose? A. There are several similar compositions in use.

(3) P. G. R. asks: If a solution be made with pure gold, nitric and muriatic acids, can the acids be drawn off leaving the gold in a powdered state; if so, how? A. Evaporate the solution, nearly to dryness in a porcelain lined iron vessel over the waterbath, to expel excess of acids; redissolve the residue in warm water, mix with 10 per cent of oxalic acid, and let stand over night. Or add to the aqueous solution 20 per cent of pure copperas (sulphate of iron) dissolved in a small quantity of warm water. Let the precipitated gold, which in the latter case is of a dull brownish color, settle, carefully decant the solution, and heat the powder to low redness.

(4) J. W. C. asks: 1. Is bay rum injurious when applied, without reducing, to the hair? A. In moderation, no. 2. Can you tell me why the bay rum which I diluted a short time ago with warm water, immediately assumed a milky white appearance and so remained, utterly devoid of the usual odor given out by good bay rum? A. It is due chiefly to the insolubility in water of the essential oils contained in the spirit. Use dilute spirit instead of water.

(5) T. S. B. asks: What is the best cement that can be used to cement a glass tube into a mercury reservoir made of iron for a pressure column at 60° pressure (and less)? In the one we have put up the mercury oozes through the pores of the plaster of Paris with which we have made the joint to connect the glass tube with the bell end of iron reservoir. A. Better adapt the surfaces by grinding; use a rubber washer and small screw clamp collar, resting on a shoulder blown in the glass. For ordinary purposes a good rubber stopper, cleanly perforated to admit the tube, will answer very well. Cements cannot be depended on in this connection.

(6) F. T. asks how the coppersmiths retin their old copper saucepans and have them look so bright inside. We do a considerable of this kind of work, but are unable to give them a bright color inside. A. Thoroughly cleanse by means of dilute sulphuric acid, or hydrochloric acid nearly saturated with zinc (acid zinc chloride), and moist pumice powder; if necessary, rinse. Warm the pan, pour in a small quantity of grain tin, melted in a ladle, and a little rosin powder; quickly brush this about with a brush made of a bunch of hemp, so as to bring the fused metal in contact with every part of the surface to be tinned. The pot or pan must be kept hot enough to prevent the tin from solidifying. As soon as the parts are properly coated, pour out the excess of melted metal, invert, and remove the selvage by means of the brush.

(7) A. W. H. writes: I have made a copying pad as per instructions in No. 21, Vol. xli., and it worked splendid first time, having taken one hundred and two good, legible impressions from one copy. Please say if an ink can be made to be used on stereotype plates and wood cuts (and not injure them) to be transferred to paper and from there to the pad, same as the ink you give directions for in above number. A. We have not experimented in this direction. Probably such an ink could be made. Have you tried a clear, saturated aqueous solution of 3B methylviolet with and without glycerine?

(8) M. H. G. asks: 1. In the plan of the "Sharpie" in the SUPPLEMENT, what is the distance on the bottom inside from deadwood to forward end of centerboard? A. The distance, 13½ feet, is given by the builder. 2. What are the dimensions of the keelson? A. The same thickness as the keel and somewhat deeper. 3. How should it be fastened to the bottom? A. Fasten through and through with rivets. 4. Am I to understand that three inches is the width of centerboard? I should not think it wide enough. I never saw one so narrow. A. 3 inches is correct.

(9) G. & B. ask: What will protect iron from sulphuric acid? Willliquid glass answer, if applied often? A. No; try a thick coating of genuine asphaltum varnish. Let it harden thoroughly before using.

(10) C. W. H. asks (1) whether in testing with tannic acid for impurity in water, the presence of the bicarbonates of sodium or calcium would affect the analysis, and if so, how. A. Heat the water, cool and filter before adding the tannin, if the water contains any considerable quantity of free carbonic acid or bicarbonates. 2. How can I test mineral spring water to detect impurities if they exist? A. Consult Wanklyn and Chapman's "Water Analysis." See also back numbers of the SCIENTIFIC AMERICAN on this subject.

(11) A. E. K. writes: I have made copying pad and ink according to directions, and work all right, but the ink does not start freely from the pen. A. Let settle, decant, and add a little alcohol.

(12) C. E. B. asks: 1. What chemical process can be used to keep water very cold? I have an air-tight vessel that contains six gallons of water, and desire to keep it cold. A. See "Ice, Artificial," Johnson's or Appleton's Encyclopedias, Knight's "New Mechanical Dictionary," and the back numbers of the SCIENTIFIC AMERICAN SUPPLEMENT. 2. How long will it remain cold? A. It will depend upon the shape, size, material, surroundings, etc., of the vessel. Consult Tyndall's a Mode of Motion."

(13) G. W. G. asks: What would be the dimensions of a cylinder capable of driving a ten horse power engine? A. It depends upon the speed at which the engines are run; ordinarily about 8 inches cylinder "Heat as by 12 inches stroke.

(14) F. T. S. writes: 1. I have two glass jars, 4x7, and a zinc. Could I make a battery with zinc in one jar and copper in the other? A. No; the zinc and copper must be in the same jar. They may be separated by a porous cell, as in the Daniell, or they may be placed one over the other in the zinc above the copper, as in the gravity. See SUPPLEMENTS, 157, 158, and 159, on the construction and operation of batteries. 2. What weight copper will I need with reference to weight of zinc? A. The weight is immaterial, but the surface should be as great as that of the zinc, and it is generally made greater. 3. What solution? A. Saturated solution of copper sulphate. 4. Will it move a sounder? A. Yes. 5. About how many feet of wire are there on sounder and relay magnets? A. Make the thickness of the wrapping equal to the diameter of the magnet core. The resistance of the relay should correspond with certain conditions of line battery, etc. 6. Will a sounder intended for short line work on a long line by winding more wire on the magnets? A. Within certain limits, but it is not a good idea. Better rewind the magnets with finer wire. 7. What is a relay used for? A. It is placed in a line for controlling a local circuit.

(15) A. P. B. asks: 1. What is the composition of the rubber used in making rubber hand stamps? A. Purified caoutchouc containing about 6 per cent of sulphur. 2. How is it melted before pouring into the mould? How is it prevented from adhering to the plaster, after cooling? A. It is not melted. See "How to Make Rubber Stamps," p. 1326, No. 83, SCIENTIFIC AMERICAN SUPPLEMENT. Also articles on vulcanizing rubber, pp. 48 and 105, Vol. 39, SCIENTIFIC AMERICAN.

(16) S. C. asks if there is a United States standard weight for a gallon of milk, and how much it is. All the milk here is sold by wine measure, 231 cubic inches to the gallon. I don't think it is right. I think in New York the milk is sold by beer measure, 282 cubic inches to the gallon. Am I right? A. 231 cubic inches is the standard gallon.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

H. W. V.—1. Hornblende, quartz, orthoclase, and calcite. 2. Graphite and hornblende. 3. Clay slate. 4. Syenite. 5. Silicious hematite. 6. Graphite in greenstone. 7. Marcasite. 8. Hematite. 9. Chiefly quartz rock. 10. Syenite with limonite.—Sample marked "geological specimens," an excellent variety of limonite, an ore of iron.—F. W. O.—The metal is antimony, probably worth 10 cents per pound in large quantities.—J. B. B.—It is jasper or chalcedony.

COMMUNICATIONS RECEIVED.

On Fly Wheels. By C. T. S.
On Railroad Crossings. By J. T.
On Temperature of the Sun By D. F. S.
On a Theory of Cold and Mild Winters. By G. R. C.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 13, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Accordion, F. Zogbaum	223,461
Acid, manufacture of anhydrous sulphuric, J. A. W. Wolters	223,571
Aging liquors, apparatus for, J. C. Vetter	223,558
Axle box, vehicle, A. J. Robinson	223,609
Bale tie buckle, J. M. Thayer	223,556
Ball trap, I. A. Paine (r)	9,042
Belt fastener, J. McGeorge	223,598
Berth guard for sleeping cars, E. A. McMann	223,527
Berth protector for sleeping cars, G. W. Farlee	223,494
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Boiler furnace, steam, C. F. Pike	223,606
Book holder, J. L. Highbarger	223,589
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Electric lighting, D. Flanery	223,495
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Horses from running away or kicking, apparatus for preventing, S. Kingsland	223,447
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Woven fabrics, J. B. Ryer	11,580

TRADE MARKS.

Duck or canvas, flax, F. Baylis & Co.	7,793
Gloves, P. Courvoisier & Co.	7,794

English Patents Issued to Americans.

From January 2 to January 13, inclusive.

Axles for vehicles, E. A. Wible, Folsom, Cal.
Buttons, attachment of, P. Chase, Pawtucket, R. I.
Churn, J. B. Williams *et al.*, Bellows Falls, Vt.
Cutting meat, machine for, Libby, McNeill & Libby, Chicago, Ill.
Electric light apparatus, T. A. Edison, Menlo Park, N.J.
Engine governors, G. F. Pottle, Boston, Mass.
Fire alarmand extinguisher, H. H. Rogers, N. Y. city.
Firearm, W. Trabue, Louisville, Ky.
Gas, manufacture of, H. C. Bull, Brooklyn, N. Y.
Gutta percha, manuf. of, H. Gerner, New York city.
Horseshoe nail machinery, L. W. Whipple, Boston, Mass.
Iron, treatment of, E. Wheeler, Philadelphia, Pa.
Lubricator, C. Parshall, Detroit, Mich.
Lubricating machinery, C. Parshall, Detroit, Mich.
Motive power from oil, C. Holland, Chicago, Ill.
Musical instruments, M. J. Mathews, Boston, Mass.
Oil, treatment of, D. D. Cattanach, Providence, R. I.
Piston rod packing, T. Tripp, Stoughton, Mass.
Railway signal, J. S. Williams, Riverton, N. J.
Rolling mills, W. H. Glover *et al.*, St. Louis, Mo.
Screw cutting machinery, D. Morrell, Hartford, Conn.
Spinning machine, A. F. Crichton, New York city.
Steam boilers, G. H. Pond *et al.*, New York city.
Steel, manufacture of, H. C. Bull, Brooklyn, N. Y.
Sleeping berths for ships, D. Parks, Boston, Mass.
Telephonic exchange apparatus, Law Telegraph Company, New York city.
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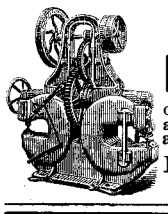

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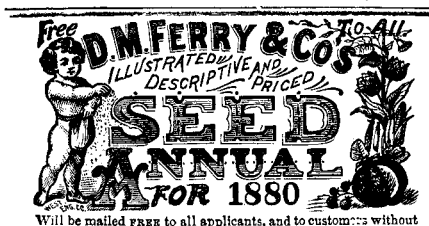

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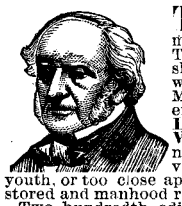
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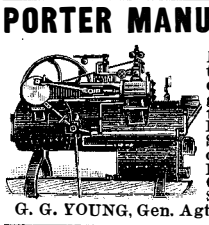
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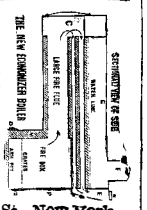

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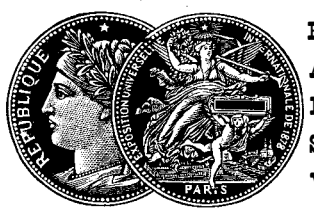

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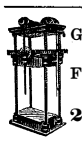
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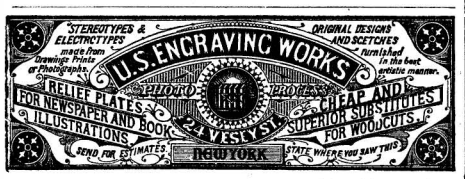
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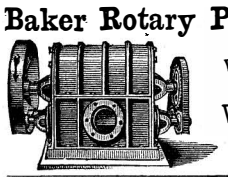

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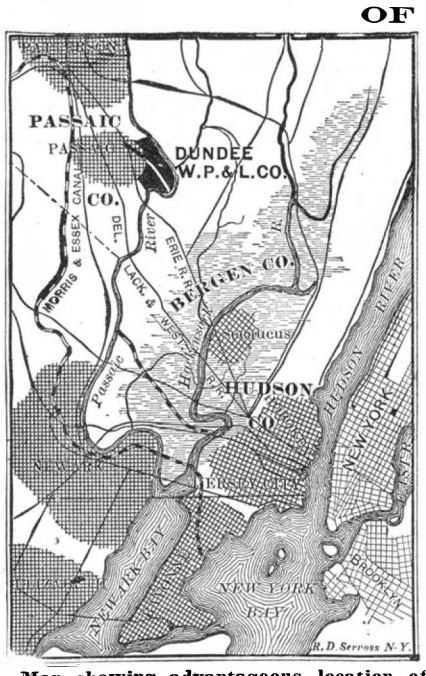

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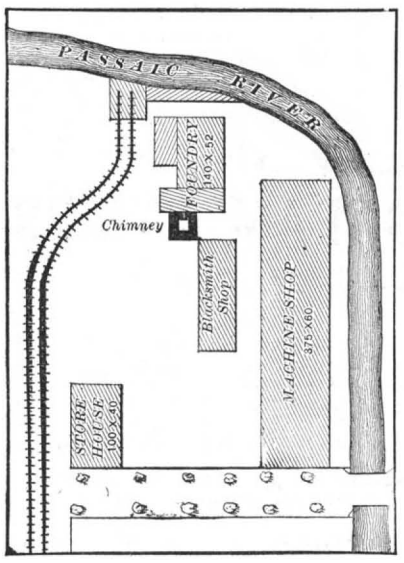

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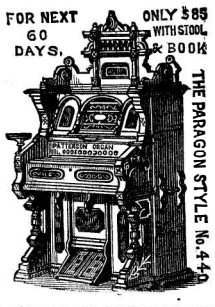

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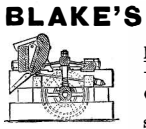

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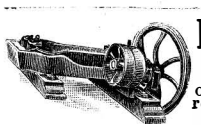

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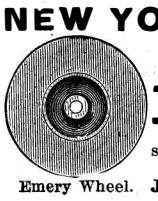

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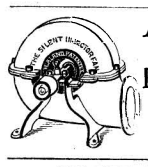

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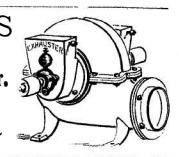

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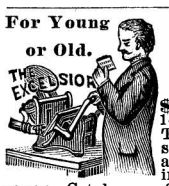

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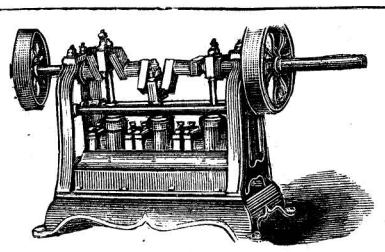

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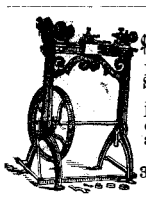

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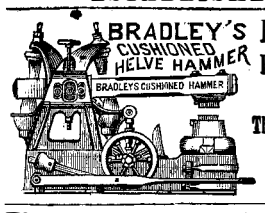

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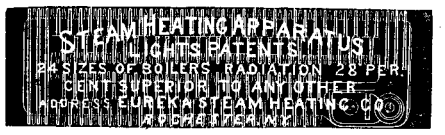
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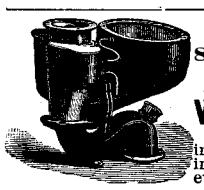

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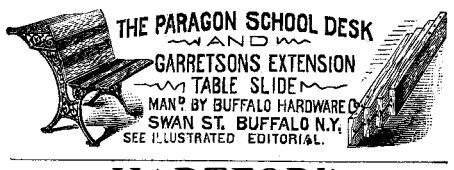

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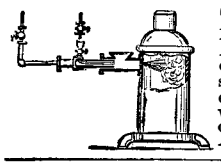

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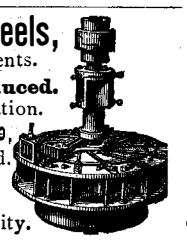

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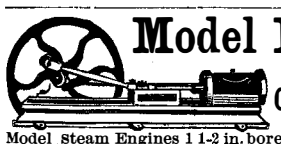

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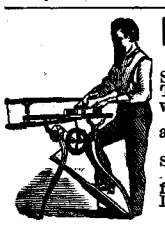

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